Rincon Creek Watershed Plan






Final May 2007

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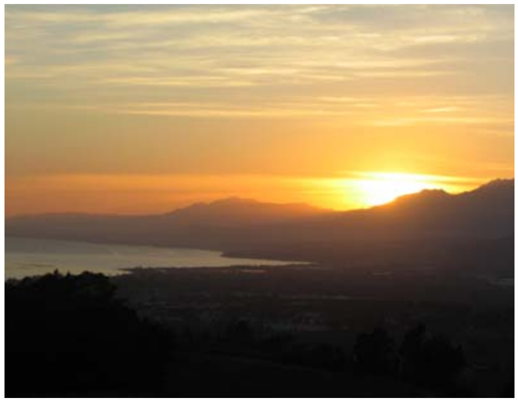

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Acknowledgements:

The Rincon Creek Watershed Plan was funded through Grant Agreement number P0350017 from the Department of Fish and Game, Fisheries Restoration Grant Program. Individual landowners within the watershed were instrumental in the development of the plan by allowing access to their property and providing input into the plan. Representatives from various public agencies were also crucial in the development of the plan.

EXECUTIVE SUMMARY

The Rincon Creek watershed encompasses 9,352 acres of residential, agricultural, and forested land on the border of Ventura and Santa Barbara Counties. To address community concerns about the health of the watershed, local landowners, community members, and resource agencies formed the Rincon Creek Watershed Council. In order to address key issues identified by the Rincon Creek Watershed Council, the Rincon Creek Watershed Plan has been developed by Tetra Tech, Inc. for the County of Santa Barbara. The Rincon Creek Watershed Council has provided input into the development of the plan.

The goal of this watershed plan is to provide a tool that can be used by stakeholders to identify, prioritize, and obtain funding to implement projects that will enhance watershed health. Specific objectives of the plan include providing an overview of the baseline physical conditions in the Rincon Creek watershed, identifying key issues affecting watershed health, developing and prioritizing projects to remedy the identified problems, and improving stewardship of the watershed's natural resources.

The Rincon Creek Watershed Council created a list of key watershed issues in February 2005. This list, which was based on landowner input, was used to guide the collection of existing data and field data during completion of the watershed plan. Field data was collected in May 2006 and focused on the issues of bank erosion, non-native vegetation, and steelhead habitat and migration. Field data on physical parameters (pH, dissolved oxygen, temperature) were also collected.

Results indicate that Rincon Creek contains fair, good, and very good steelhead habitat, but that the habitat is located upstream of an impassable barrier at the Highway 101 culvert. Bank erosion along Casitas Creek, the main tributary to Rincon Creek, contributes to highly turbid water and fine sediment deposition on the bed surface, lowering habitat quality in Casitas Creek and in the mainstem of Rincon Creek that is downstream of Casitas Creek. Based on this finding, Casitas Creek should be a lower priority for steelhead restoration than the mainstem of Rincon Creek. Rainbow trout were observed within the mainstem Rincon Creek that is upstream from the confluence with Casitas Creek. The physical parameters collected throughout Rincon Creek were within the ranges previously reported for other southern California streams that are known to support steelhead populations. However, the highly turbid water that is present downstream of the confluence with Casitas Creek degrades the steelhead habitat within the lower mainstem of Rincon Creek. Other results indicate that projects to eradicate non-native, invasive plant species and restore the riparian corridor would improve watershed health by increasing the quality and availability of riparian habitat and attracting native wildlife.

A total of 24 projects were developed to address many of the key issues identified by the Rincon Creek Watershed Council. The key issue areas addressed by the projects are ones for which pre-existing data is available or field data was collected in the formation of this watershed plan. In some cases, additional data is needed to address key issues raised by stakeholders.

The projects were prioritized based on the estimated level of technical impact and feasibility factors, including cost, time to complete, and landowner interest. Six projects were given the highest priority after feasibility was taken into account: 1) Implementation of best management practices on agricultural lands, 2) Giant reed eradication, 3) Biotechnical stabilization of medium eroded or unstable banks, 4) Restoration of riparian habitat, 5) Toe stabilization of large erosional features, and 6) Creation of floodplain inset benches. The watershed plan describes the next steps in implementing these six projects and identifies potential landowner incentives and funding sources for project implementation. From a steelhead restoration perspective that does not include feasibility factors, remediation of the Highway 101 culvert for steelhead passage is the highest priority project, since the culvert currently blocks access to all upstream habitats. The 24 recommended projects are provided in the table below in no particular order.

Rincon Creek Recommended Projects

Code	Project Title
SED-1	Toe Stabilization of Large Erosional Features
SED-2	Biotechnical Stabilization of Medium Eroded or Unstable Banks
SED-3	Creation of Floodplain Inset Bench
SED-4	Bed Stabilization of Tributaries
SED-5	Implementation of Best Management Practices
SED-6	Roadway Sediment Source Assessment
SED-7	Increased Education Regarding Sediment Control Methods
WEED-1	Vegetation Management Plan
WEED-2	Giant Reed Eradication
WEED-3	Ivy and Nasturtium Eradication
WEED-4	Education Program
RIP-1	Restoration of Riparian Habitat
RIP-2	Rock Quarry Restoration
WQ-1	Increased Agency Coordination
WQ-2	Volunteer Water Quality Monitoring Program
WQ-3	BMI Sampling
WILD-1	Remediation of the Highway 101 Culvert
WILD-2	Removal of Rincon Creek Steelhead Upstream Migration Barriers
WILD-3	Removal of Casitas Creek Steelhead Upstream Migration Barriers
WILD-4	Wildlife Migration Study
WILD-5	Steelhead Monitoring Project
WILD-6	Spring/seep Analysis
AGREE-1	Safe Harbor Agreement
POINT-1	Rincon Point Access Road Protection Study

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1.0 INTRODUCTION

1.1 DESCRIPTION OF THE WATERSHED

The Rincon Creek watershed encompasses 9,352 acres on the border of Ventura and Santa Barbara Counties (calculated based on County of Santa Barbara GIS files). The watershed extends about 7.5 miles from the ocean to the ridge of the Santa Ynez Mountains at an elevation of 4,800 feet. The watershed is shown in Figure 1-1.

Flow from the watershed moves in a southwestern direction and empties into the ocean at Rincon point, just east of the City of Carpinteria. Development on Rincon point consists of a small gated residential community and the Rincon Beach parking lot. A small lagoon is present at the creek mouth. The size of the lagoon is dependent on rainfall, the season, and tidal waters. Upstream from the ocean Rincon Creek flows through a large culvert under Highway 101.

Long Canyon Creek and Casitas Creek are the two main tributaries to Rincon Creek, which is the mainstem of the watershed. Numerous tributaries flow into the mainstem in addition to many natural springs that discharge into the creek. Key features of the watershed are shown in Figure 1-2.

Land use in the watershed is primarily agriculture, with some residences, scattered horse corrals, and recreation. Table 1-1 provides additional characteristics of the watershed.

Table 1-1: Characteristics of Rincon Watershed

Characteristic	Value
Size (acres)	9,362
Max. elevation (feet)	4,782
Mean elevation (feet)	1,518
Stream length (miles)	34
Min. precipitation (inches)	15
Max. precipitation (inches)	29
Mean precipitation (inches)	22
Number of wetland types	6

Source: Stoecker *et al.* 2002. Stoecker *et al.* 2002 relied upon previous County of Santa Barbara GIS files to calculate total acreage.

Fifty years ago, Rincon Creek was home to plentiful runs of steelhead trout, which migrated each spring to spawning and feeding habitat in the upper watershed. Steelhead populations have declined drastically as impacts from human activities have altered the creek and its drainage basin. Those impacts include: barriers to upstream passage; loss of native vegetation and an influx of non-native, invasive plant species; increased scouring of creekbeds and streambanks; diversions of streamflow and groundwater; modifications to the creek channel and streambanks; and degraded water quality because of nutrient, sediment and other polluted runoff from agricultural and residential development.

1.2 PURPOSE AND USE OF THE PLAN

Santa Barbara County received a grant from the California Department of Fish and Game (CDFG) to develop a watershed plan for the Rincon Creek Watershed in southern Santa Barbara County and northern Ventura County. The focus of the Rincon Creek Watershed Plan is to identify opportunities and projects to improve steelhead habitat and passage, and improve water quality and other creek functions.

The Rincon Creek Watershed Plan is the first step in the local planning process to identify problems, develop solutions, and focus efforts to restore, sustain, and enhance the watershed. The watershed plan has been identified as the key required in opening the door to future local, state, and federal grants and loans necessary to implement identified management strategies.

1.3 RINCON CREEK WATERSHED COUNCIL

The Rincon Creek Watershed Council (RCWC) was formed in October 2004, is organized by the Community Environmental Council (CEC), and is funded by a grant from the CDFG.

The RCWC is a collaboration of landowners, local growers, community groups, resource agencies, and individuals whose objective is to improve the conditions of the Rincon Creek watershed. The Council meets once a month to discuss activities in the watershed and identify projects to improve and protect the creek resources. RCWC meeting objectives include:

- Provide a community forum for consideration of the purpose and specific goals of the project.
- Identify opportunities for stakeholder participation.
- Gather input and incorporate suggestions into documents produced throughout the lifetime of the project.
- Ensure that all stakeholders have an opportunity to participate in the development of the watershed plan.

A key part of developing the watershed plan was facilitating dialogue among stakeholders within the watershed. This was needed to establish the watershed as a necessary focus of public attention, create an understanding of the watershed, establish a goal among different organizations, and to share perspectives for future change. Tetra Tech, Philip Williams & Associates (PWA), Santa Barbara County staff, and the CEC have worked with the RCWC to identify areas of concern and potential projects.

The RCWC assisted with guiding the goals of the project, identifying key issues within the watershed, compiling existing data, pulling together the historical conditions of the watershed, gaining access to private property for the fieldwork, and provided comments on the various preliminary findings of the project.

RCWC meetings were designed to ensure that the watershed plan is developed based on the needs of the community and to encourage open communication between all stakeholders. During development of the watershed plan, a primary project objective was to use the meetings as a forum to provide stakeholders with a long-term comprehensive framework to protect and enhance watershed conditions. The RCWC meetings are attended by interested project stakeholders.

Stakeholders have included:

- Local landowners
- Agricultural Watershed Coalition
- CDFG
- NOAA Fisheries
- Natural Resources Conservation Service (NRCS)
- Santa Barbara and Ventura Counties
- Southern California Wetlands Recovery Project
- California Department of Transportation
- Coastal Conservancy
- Southern California Steelhead Coalition
- Carpinteria Sanitary District
- Central Coast Regional Water Quality Control Board (RWQCB)
- Cachuma Resource Conservation District (RCD)
- Santa Barbara County District Supervisor Representative for Salud Carbajal

Minutes from the monthly RCWC meetings are available for download from the Rincon Creek website at www.rinconcreek.org. Various documents presented to the stakeholders are also available on the website. The logo of the RCWC is provided as Graphic 1-1.

Graphic 1-1: RCWC Logo.
Designed by Whitney Abbott.

1.4 KEY DATES IN THE DEVELOPMENT OF THE PLAN

Work on the Rincon Creek Watershed Plan began in August 2005. Throughout the development of the watershed plan, various attempts have been made to obtain input from stakeholders. Meetings of the RCWC are regularly advertised and email reminders are sent, CEC and Tetra Tech staff interviewed various landowners in the watershed, special events have been co-hosted with the Carpinteria Creek Watershed Coalition, booths at local festivals have included information about the watershed plan, and the website of the RCWC is regularly updated. Despite these efforts, attendance at the regular RCWC meetings has remained low. However, during the almost two year time period during which the watershed plan has been developed, various landowners and stakeholders have provided input. Key dates in the development of the plan are summarized below.

October 2004	RCWC formed
May 2005	Request for proposals from Santa Barbara County issued
August 2005	Tetra Tech selected to prepare the watershed plan
September 2005	Tetra Tech began to attend RCWC meetings
November 2005	Watershed preliminary outline developed
March 2006	Draft Field Work Plan presented to the RCWC
April 2006	Final Field Work Plan presented to the RCWC
May 2006	Field survey performed
June 2006	Preliminary Field Data Collection Summary presented to the RCWC

October 2006	Field Data Summary presented to the RCWC
December 2006	Additional field data collected
February 2007	Draft Watershed Plan presented to the RCWC and posted online
Mid-April 2007	Comments on Draft Watershed Plan requested
Mid-May 2007	Pre-final Watershed Plan presented
June 2007	Final Watershed Plan posted online and distributed

1.5 PLAN CONTRIBUTORS

Key contributors to the development of the watershed plan that are members of public or private organizations are listed in Table 1-2. Several landowners also provided valuable input into the plan.

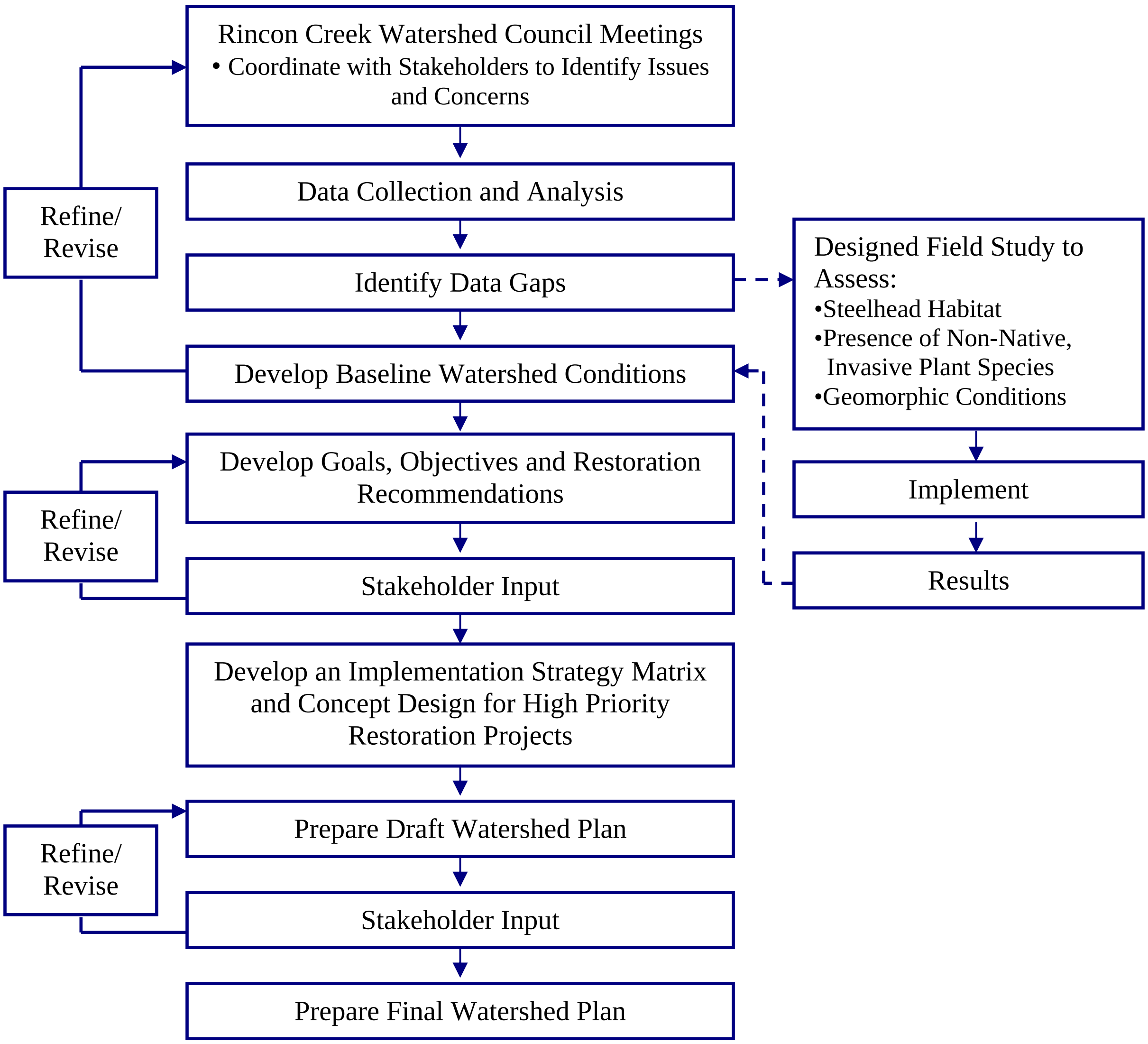
Table 1-2: Plan Contributors

Agency Name	Contact	Phone Number
Tetra Tech	Michelle Bates	(805) 681-3100
Tetra Tech	Heather Moine	(805) 681-3100
CEC	Mauricio Gomez	(805) 963-0583
CEC	Suzanne Feldman	(805) 963-0583
CEC	Katie DeLeuw	-
PWA	Setenay Bozkurt	(415) 262-2300
PWA	Andrew Collison	(415) 262-2300
County of Santa Barbara	Candice Constantine	(805) 568-3546
County of Santa Barbara	Darcy Aston	-
County of Santa Barbara	Michelle Gibbs	-
CDFG	Mary Larson	(562) 342-7186

Note: Contact information is not provided for individuals that are no longer with the agencies listed.

2.0 WATERSHED PLANNING APPROACH

The approach in developing the Rincon Creek Watershed Plan was to meet with stakeholders early and often in the process, to identify any additional data needed, and when possible, to obtain information to fill any data gaps. Once this data was collected, a baseline condition of the watershed was established, and the watershed plan was developed that included recommended projects to remedy key issues that were identified. This planning process is illustrated in Graphic 2-1.



Graphic 2-1: Watershed Plan Development Process

The following key questions were evaluated during all phases of the watershed planning process:

- How does the system work, and what roles do individual components play (for example, groundwater, surface runoff, or terrestrial features) in controlling the functions?
- What natural features or characteristics in the watershed are important to water quantity and quality and habitat quality and function, and how do they influence overall environmental conditions?
- What management measures are necessary to restore, protect, or enhance key watershed functions and features?
- What is the overall management strategy necessary to meet the goals and objectives for the watershed?

A comprehensive, ecosystem-based approach was used during the assessment and development of the Rincon Creek Watershed Plan. This approach requires an understanding of how the watershed functions as an ecosystem and the interrelationships between separate features or subsystems, particularly the linkages between land use and watershed conditions. Ecosystem elements that were considered and evaluated during the development of the watershed plan include the human, aquatic, riparian, and terrestrial features, conditions, processes, and interactions within the watershed.

2.1 GOALS AND OBJECTIVES

An overall goal of the project is to develop the watershed plan in sufficient detail and quality so that it will serve as a tool that can be used by various stakeholders to identify and prioritize projects and pursue funding opportunities. The watershed plan is also anticipated to assist in the development of other related plans that would also benefit the steelhead, such as ranch management plans.

The intent of the Rincon Creek Watershed Plan is to provide guidance to federal, state, and local governments, agencies, districts, and citizens in restoring, protecting, and enhancing the health of the Rincon Creek watershed and its associated aquatic resources. Objectives of the plan include:

- To provide an overview of the baseline physical processes within Rincon and Casitas Creek.
- To identify key issues affecting watershed health.
- To identify and prioritize projects to remedy problems identified in the watershed.
- To improve understanding, appreciation, and stewardship of the Rincon Creek watershed.

3.0 KEY ISSUES

The RCWC developed a list of issue areas during February 2005. During a data gaps analysis conducted for the watershed plan, it was determined that for many of the issue areas identified by the RCWC there was a lack of existing data. A field study was designed and implemented to fill many of these data gaps. Once the field data was collected, it was used along with the existing data to summarize the baseline watershed condition (Section 7.0). The recommended projects (Section 10.0) were designed to address the key issues areas that contain data and many of the key issue areas for which data is lacking.

Table 3-1 provides the list of key issue areas that was developed by the RCWC in February 2005 and states how these areas are addressed by the watershed plan. The remainder of Section 3.0 provides additional information on key issues areas for which there is data (existing data or field data collected for the watershed plan).

Table 3-1: Key Issues

Key Issue	How Addressed in the Watershed Plan	Recommended Projects
Erosion and Sedimentation	Included in field data collection and analysis.	SED-1 through SED-7, POINT-1
Species Diversity and Population	Included in field data collection and analysis.	RIP-1, WILD-1 through WILD-6
Runoff from Roads, Parking Lots	Additional field data not collected.	SED-6
Water Rights and Water Usage	Additional data not collected. Population and development trends discussed in Section 7.7.1.	None
Assistance to Landowners in Restoration Projects	Funding sources identified in Section 11.0 and landowner incentives identified in Section 12.0.	NA
Impact of Exotic Species (pro and con)	Included in field data collection and analysis.	WEED-1 through WEED-4
Community Education	Part of the process of developing the watershed plan.	SED-7, WEED-4
Pathogens and Other Water Quality Issues	Additional field data not collected.	WQ-1 through WQ-3
Funding and Long-term Maintenance of Projects	Funding sources identified in Section 11.0.	All
Low-flow Crossings (impacts and solutions, tax impact of improvements)	Tax impacts discussed in Section 11.0 and landowner incentives described in Section 12.0.	WILD-2, WILD-3, AGREE-1
Control Burn	Information on Forest Service management practices provided in Section 7.8.4.	WEED-1
Steelhead Tolerance of Turbidity	Data from Rincon compared to other southern California streams with steelhead populations in Section 7.6.6.	WILD-5
Preservation and Restoration of Lagoon	Additional field data not collected.	POINT-1
Debris Flows During Floods	Not addressed. No current management activities address the containment of debris flow. Project WILD-1 states that any culvert retrofit project should analyze changes in debris flow.	WILD-1
Flow Conditions	Relied upon existing data for Carpinteria Creek.	NA
Incentives for Restoration and Implementation	Addressed in Sections 11.0 and 12.0.	NA
Potential for Development in the Watershed	Analyzed permit records from Santa Barbara and Ventura County, also reviewed population data (Section 7.7.1).	NA
Incentives for Protection of Agriculture	Addressed in Sections 11.0 and 12.0.	NA
Archaeological Assessment History	Not addressed.	None
Fire Management and Vegetation and Road Management in Los Padres National Forest	Information on Forest Service management practices provided in Section 7.8.4.	SED-6, WEED-1
Land Use and Vegetation Conditions, Practices in Casitas Creek and Other Sections of Rincon Creek	Existing data analyzed and additional field data collected.	SED-1 through SED-7, WEED-1 through WEED-4, RIP-1

Notes: The key issues listed were developed by the RCWC in February 2005. NA=Not applicable.

3.1 EROSION/SEDIMENTATION

The Rincon Creek watershed is an erosional landscape set in mountainous terrain. The watershed is inherently unstable and erosion-prone due to rapid tectonic uplift, active faults, very weak rocks, and steep slopes. Landslides, debris flows, bank erosion and excess sedimentation are common in the watershed. These conditions likely existed before European settlement in the area. However, land use practices including modification of stream channels, road building, and agricultural activities in general and streamside agriculture in particular have likely compounded the naturally-unstable conditions in many parts of the watershed. Tables 3-2 and 3-3 list potential impacts on the hydrology and geomorphology of land use changes in the Rincon Creek watershed.

The key issues in regard to erosion in the watershed are mass failures (landslides and debris flows) on hills and valley walls directly connected to the streams, stream bank erosion, and more diffuse erosion from dirt roads and agricultural areas. These issues have implications for water quality and steelhead habitat.

The accelerated erosion results in excess sedimentation in Rincon and Casitas Creeks. The excess sediment in the channels deposits in pools and other lower velocity areas.

Table 3-2: Hydrologic and Geomorphic Effects Associated with Streamside Agricultural Activities

Outcomes of Change In Land Use	Possible Hydrologic Effect	Possible Geomorphic Effect
Drainage reconfiguration (i.e. reducing the number of small ephemeral channels)	Increase in peak discharge. Decrease in lag times of floods.	Increase in erosive stresses in the channel resulting in increases in bank failures. Undermining of banks. Increase in sediment yield.
Homogenization of land surface	Reduction in the amount of depression storage. Decrease in infiltration rates. Increase in peak discharge. Decrease in lag times of floods.	Increase in erosive stresses in the channel resulting in increases in bank failures. Undermining of banks. Increase in sediment yield.
Compaction of land	Decrease in infiltration rates coupled with increase in overland flow, which in turn results in increase in the magnitude and flashiness of peak flows.	Increase in surface erosion and some increase in bank erosion. Some increase in sediment yield.
Vegetation removal on floodplain	Reduced evapotranspiration and interception.	Increase in sheetwash erosion. Rilling.
Removal of native stream-side vegetation	Reduced evapotranspiration and interception.	Bank resistance decreases resulting in increased number and extent of failures. Increase in sediment yield.
Water diversions for agricultural purposes and groundwater pumping	Decrease in flow between points of diversion and disposal. Reduced soil moisture in riparian zone.	Reduction in transport capacity.
Stream channels put in artificial channels or culverts	Increased flood damage if culverts are undersized. Increased backup flows. Increased downstream peak flood flows if channelized.	Changes in channel geometry and sediment load. Increases in stream channel stability problems. Aggradation and flooding upstream- of project structure. Stream-channel stability problems and loss of floodplain storage.

Table 3-3: Hydrologic and Geomorphic Effects Associated with Increasing Urbanization

Outcomes of Change	Possible Hydrologic Effect	Possible Geomorphic Effect
Drainage reconfiguration (i.e. reducing the number of small ephemeral channels)	Increase in peak discharge. Decrease in lag times of floods.	Increase in erosive stresses in the channel resulting in increases in bank failures. Undermining of banks. Increase in sediment yield.
Homogenization of land surface	Reduction in the amount of depression storage. Decrease in infiltration rates. Increase in peak discharge. Decrease in lag times of floods.	Increase in erosive stresses in the channel resulting in increases in bank failures. Undermining of banks. Increase in sediment yield.
Compaction of land	Decrease in infiltration rates coupled with increase in overland flow, which in turn results in increase in the magnitude and flashiness of peak flows.	Increase in surface erosion and some increase in bank erosion. Some increase in sediment yield.
Vegetation removal on floodplain	Reduced evapotranspiration and interception.	Increase in sheetwash erosion. Rilling.
Removal of native stream-side vegetation	Reduced evapotranspiration and interception.	Riparian areas are eliminated or degraded. Bank resistance decreases resulting in increased number and extent of failures. Increase in sediment yield.
Water diversions for agricultural purposes and groundwater pumping	Decrease in flow between points of diversion and disposal. Reduced soil moisture in riparian zone.	Reduction in transport capacity.
Increase in impervious surfaces (including roads)	Decrease in infiltration. Increase in streamflows. Increase in peak discharge. Decrease in lag times of floods. Decrease in water table levels. Flow concentration.	Increase in erosive stresses in the channel resulting in increases in bank failures. Undermining of banks. Gully formation. Increase in sediment yield.
Stream channels put in artificial channels or culverts	Increased flood damage if culverts are undersized. Increased backup flows. Increased downstream peak flood flows if channelized.	Changes in channel geometry and sediment load. Increases in stream channel stability problems. Aggradation and flooding upstream- of project structure. Stream-channel stability problems and loss of floodplain storage.

3.2 STEELHEAD HABITAT

Southern California steelhead (*Oncorhynchus mykiss*) includes those populations from Santa Barbara County south to the U.S.-Mexico border. Steelhead are rainbow trout with a life cycle similar to that of a salmon. It is an anadromous species; steelhead are born and reared in freshwater streams. As juveniles they migrate to estuaries where they adjust to saltwater, and then migrate to the ocean to mature into adults. After spending one to three years foraging on the food sources of the Pacific, large adult steelhead return to freshwater streams to reproduce. Unlike salmon, steelhead do not necessarily die after spawning and may make the spawning journey more than once. Juvenile steelhead reside in coastal streams from one to three years before migrating to the ocean. Steelhead use all segments of a stream system to complete the freshwater phase of their life cycle.

Southern steelhead are known as a winter run fish with adults entering coastal streams seeking gravel beds to spawn following storms during the winter rainfall period. After a brief incubation, fry emerge and reside in freshwater for one to as long as three years before their downstream migration to the ocean. In smaller coastal streams, lagoons and estuaries can play an important role allowing the fish to adapt from freshwater to seawater and providing copious food to allow juveniles known as smolts to grow quickly and prepare for ocean entry.

Since the post-World War II era, Southern California's steelhead have declined the most of all of California's distinct populations (McEwan and Jackson 1996). In 1997, under the federal Endangered Species Act, the Southern California steelhead was listed as endangered by NOAA Fisheries.

In 2002, M.W. Stoecker and the Conception Coast Project published the *Steelhead Assessment and Recovery Opportunities in Southern Santa Barbara County, California* (Stoecker *et al.* 2002). The study identified restoration actions for wild, southern steelhead in 24 watersheds and sub-watersheds from Jalama Creek to Rincon Creek. Rincon Creek was determined to have a high quantity and quality of steelhead habitat, which combined to give it the sixth highest habitat ranking out of the 24 watersheds and sub-watersheds evaluated. Overall, Rincon Creek was given the eighth highest ranking for steelhead recovery out of the 24 watersheds and sub-watersheds evaluated.

3.3 BARRIERS TO UPSTREAM STEELHEAD MIGRATION

Rincon Creek and Casitas Creek contain several structures that act as barriers to upstream steelhead migration. The Highway 101 culvert is the most significant barrier to upstream migration in the watershed. It is impassable (by steelhead) under all flows, effectively blocking the entire watershed for use by steelhead (Stoecker *et al.* 2002). In the rest of the watershed, barriers are typically road crossings, many of which are privately owned.

3.4 WATER QUALITY

Numerous past and current water quality sampling activities occur within the watershed. In general, the following has been observed:

- Elevated nitrogen and phosphorus levels.
- Ammonia occurs at concentrations shown to be toxic to aquatic life.
- Elevated bacteria levels, particularly during the first rainfall of the year.
- Elevated sediments within Casitas Creek and within various locations of Rincon Creek.
- Impaired for boron (toxicity).

3.5 NON-NATIVE, INVASIVE PLANT SPECIES

There are several non-native, invasive plant species present within the watershed. Ivy (Cape and English) is present throughout the watershed. In many cases, large areas of the creek banks are covered in a mixture of ivy and nasturtium. Giant reed (*Arundo donax*) also occurs within the lower watershed, although the level of infestation is much lower than that of other local creeks, like Carpinteria Creek. Other non-native, invasive plants present within the watershed are eucalyptus trees, iceplant, tree tobacco, pampas grass, and castor bean. Several landowners have expressed interest regarding containing the spread of ivy within the watershed.

3.6 RIPARIAN CORRIDOR

The riparian corridor is the assemblage of plant communities that require elevated soil moisture levels found along watercourses. The riparian corridor is distinctly different from surrounding lands due to the unique soil and vegetation characteristics associated with the presence of groundwater, as well as periodic flooding and disturbance. It serves as the transitional zone and connection between the aquatic and terrestrial ecosystems and is an important, diverse, and productive ecosystem.

Riparian areas play a vital role in maintaining the stability of watercourses. Roots of riparian vegetation help to stabilize banks, reducing erosion by holding soil in place. Vegetation binds soil and creates roughness that reduces stream velocities, particularly during floods. Vegetation at the toe of riverbanks is especially important to riverbank stability, particularly on outside bends of meanders and on other banks where flow is deflected. In addition, roots and rootballs allow the formation of overhanging banks, which provide high quality habitat for many aquatic organisms.

A well-vegetated riparian corridor serves a number of valuable functions for flood control. Low-lying floodplain areas next to stream channels combined with riparian vegetation reduce the water velocity and allows floodwaters to spread out through the riparian corridor and re-enter the main channel slowly, thus reducing downstream flood potential. Additionally, floodplain soils are often quite porous and roots of riparian vegetation further increase the porosity of the soil allowing large amounts of water to infiltrate and reduce the overall volume of water moving downstream. Furthermore, riparian vegetation uses large amounts of water in the process of transpiration, pulling water out of the soil, which increases the overall water holding capacity of the floodplain soil.

Riparian corridors also provide habitat for wide variety of plant and wildlife species. Wildlife species may use riparian areas as migration corridors. Riparian habitats also typically support a diverse assemblage of bird species.

Within the Rincon Creek watershed, there is a lack of an intact riparian corridor. There are areas within Rincon and Casitas Creeks where riparian species have been replaced with avocado trees, where pipe and wire revetment has degraded riparian habitat, where rip-rap has been placed without vegetation, and where steep creekbanks lack riparian habitat.

4.0 HISTORICAL CONDITIONS

4.1 LAND USE

Chumash Indians thrived by the waves of Rincon far before the first Europeans appeared in 1542. When Juan Rodriguez Cabrillo sailed up the California coast, Chumash paddlers, in their tomols, or canoes, came out to meet the fleet, displaying no signs of fear of these newcomers. This band of Chumash that called Rincon home were called Suku or Shuku. The Chumash called the area “Xuco” and it was an inspiring place for them, whether collecting cockleshells and snails, catching sea fish, or savoring the steelhead trout that lived in Rincon Creek. Cabrillo especially loved Carpinteria, a place that was “very beautiful and filled with people, a level country with many trees” (Kelsey 1986).

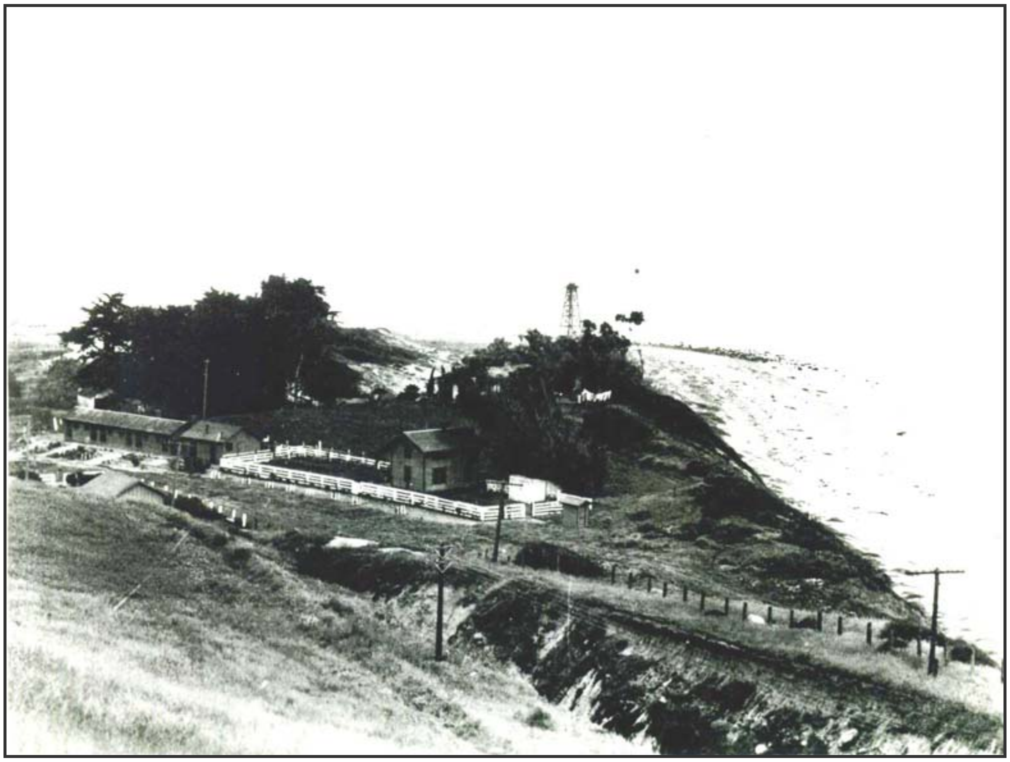
In 1966, archaeologists from the University of California at Santa Barbara (UCSB) completed a study in which they sifted through piles of Chumash middens that were fifty to sixty feet deep. The artifacts they found included arrows, spear heads, pottery, and more. This data indicated that Rincon Point had been continuously occupied for up to 7,000 years. Bobette Bates McCay, the granddaughter of Dr. Charles Bates, has been quoted as saying “After a storm, when we were children, we’d run to the creek and there would be the beads, all shiny and waiting for us. Every time the creek changed its course, it would uncover more artifacts” (Ventura County Star 1992).

In 1835, approximately 4,459 acres of land were granted to Teodoro Arellanes by Governor Jose Castro. This site became known as Rancho El Rincon. In 1850, when California entered the Union, Arellanes was required to prove ownership of the Rancho by filing a petition for confirmation of a land grant. After initially being rejected, he filed the claim again, but died in 1858 before the 1872 decision to reverse his rejection.

Arellanes’ daughter, Maria de Jesus, married Dr. Matthew H. Biggs in 1853. Arellanes conveyed a large portion of Rancho El Rincon to his son-in-law, for $1.00 an acre. Half of the ranch was given to Biggs, although assessment records from 1857 show 4,000 acres under Biggs’ name, which was nearly the whole original acreage. In 1868, tax records showed his property as 3,000 acres.

In 1882, Biggs sold Rancho El Rincon to his former business partner Benigno Gutierrez, and to a Dr. Charles Bates. Dr. Bates’ property followed Rincon Creek from its mouth to 1.5 miles upstream. Gutierrez and Bates sold 50 to 60 acres to Gutierrez’s son-in-law, Reuben W. Hill. Much of that property was kept in the Hill family until several years ago. The area known today as Rincon Point was previously known as Hill’s Point.

Reuben Hill, now a land owner, married Carmen Gutierrez, Benigno’s daughter. They lived at Rincon Ranch by the coast for many years until a huge storm washed their house away in 1914. They rebuilt higher up on the hill, and the house still stands there today. Dr. Hill experimented with different crops on the land, and the area was also used as a setting for early western movies, given the sage-brush covered hills. A photograph of Rincon Point during the early 1900s is provided as Graphic 4-1.



Graphic 4-1: Historical Photo
Source: Doug White.
Notes: View looking South East on Rincon Point in the early 1900's. The creek mouth is at far left of picture.

The Bates-Gutierrez partnership ended when Benigno Gutierrez died in 1902, and Dr. Charles Bates sold part of Rancho El Rincon.

A stage coach crossed the property at Rincon Point and at one time there was a stage coach stop there. Vehicles had problems with large boulders on the sand and transportation was difficult. A right of way was granted to the Southern Pacific Railroad in 1887 and narrow ledges were blasted for the tracks. Since there was no room for a wagon road after that, the idea of building a series of wooden causeways around the cliffs was first developed in 1910. The causeway was a timber pile trestle with a 16-foot wide roadway and was a cooperative project between Santa Barbara and Ventura counties. By 1912, this was part of the state highway system, and in 1926, was replaced with cement concrete pavement. The highway was widened to four lanes in 1949, and was protected by a rip-rap seawall consisting of boulders weighing up to ten tons. Finally, in 1971, Highway 101 was completed.

Rincon Inn, Ruby’s Road House, and the Maryland Inn were all various names for a building known for illegal alcohol production and wild parties at Rincon Point. The famed Madame Sally Stanford brewed gin in the bathtub of her Santa Paula home and then sold it down at the point. Illegal supplies of alcohol were also dropped off from boats. The military had a lookout next to the beachfront home of the Hill’s during World War II. After the war, the property began to take on its current appearance.

In the 1950s, a rock quarry operation began in the upper portion of Rincon Creek (upstream from Sulphur Creek). Landowners have indicated that before the quarry operation began, this was the location of a large natural waterfall (over 70 feet in height). The original owner and operator of the quarry is unclear. However, in a CDFG interoffice correspondence there is reference to the Adkinson Construction

Company as an operator of the quarry in 1956 (CDFG 1956). Currently, the rock quarry stretches an estimated length of 550 meters within the upper watershed.

In 1969, large flooding occurred within Rincon Creek. Damage to properties at Rincon Point occurred, as shown in Graphic 4-2.

Graphic 4-2: Rincon Point After Flooding that Occurred in 1969
Source: Doug White.

Following the 1969 flood, the U.S. Army Corps of Engineers installed unvegetated fill at Rincon Point, as shown in Graphic 4-3.

Graphic 4-3: Fill at Rincon Point, after January 1969
Source: Doug White.

Although the fill placed in 1969 eroded, it has been gradually replaced over time and native and non-native vegetation is currently growing within the area. During high flows, erosion occurs along the streambanks at Rincon Point.

A history of the Highway 101 culvert has been provided by Caltrans and is summarized here (Cesena 1994). In 1928 the original 118-foot long arch culvert was installed. In 1949, the culvert was extended by approximately 50 feet at the outlet and 45 feet at the inlet. In 1968, the current six-lane freeway was built, and the culvert was extended by approximately 610 feet at the inlet. This is likely also when the steeply sloped inlet (15 percent) was also installed. In 1971 an energy dissipater was constructed at the outlet.

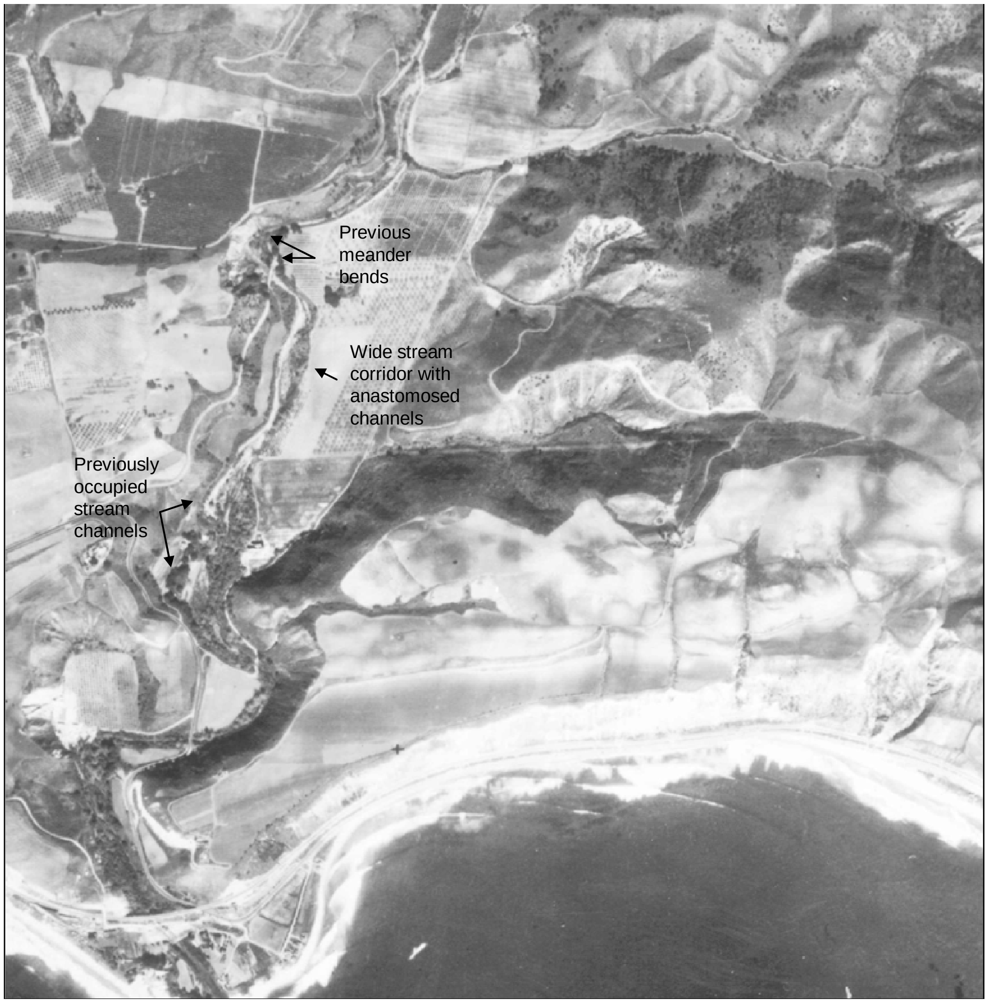
A timeline depicting changes in the watershed over time is provided in Figures 4-1A and 4-1B.

4.2 GEOMORPHOLOGY

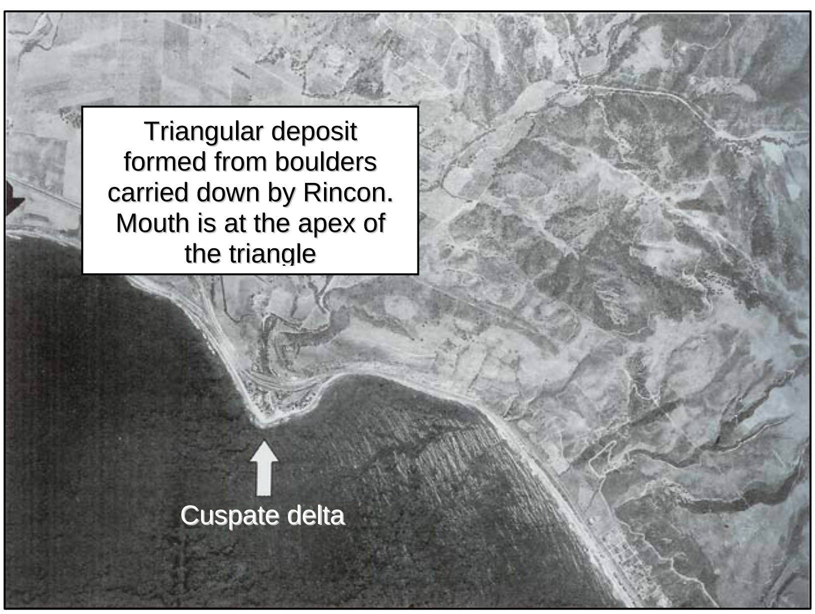
Rincon Valley was taken into agricultural production during the 1970s. The land was mainly developed into avocado orchards. The creekbeds of Rincon Creek and Casitas Creek, as well as their riparian corridors, have been modified in numerous ways over time. Early aerial photographs of the watershed indicate that the riparian corridor along Rincon Creek was eliminated along certain reaches as early as 1929 (Graphic 4-4).

Historically, Rincon Creek was a series of anastomosed stream channels that meandered across the Rincon Valley (Graphic 4-4). The creek meandered within a wide corridor with multi-thread channels at certain locations. The creeks in the watershed were not entrenched as they are presently, but were connected to their floodplain.

Rincon Creek empties into the ocean at Rincon Point, which is a headland along the coast and is a small cuspate delta. It is a triangular deposit with a single, centered stream course whose mouth is at the apex of the triangle. The Rincon Creek delta is formed from boulder deposits carried down to the shore by Rincon Creek during flood events and debris flows (Graphic 4-5) (Norris 2003).



Graphic 4-4: Aerial Photo from 1929



Graphic 4-5: Rincon Creek Delta Formation
Source: Norris 2003.

4.3 BIOLOGICAL RESOURCES

An examination of aerial photographs of the watershed indicates that prior to the 1970s the watershed consisted of large areas of oak woodlands, mixed with chaparral and shrub habitats. Since that time, the watershed has been gradually developed. Large areas of open space have been replaced with avocado orchards (and some lemon orchards), often times on steep hillslopes.

A large percentage of the watershed occurs within the Los Padres National Forest. That, combined with the agricultural uses within the watershed, indicates that the area represents a large expanse of habitat for a wide variety of animal and plant species. The area has been noted for its diverse assemblage of bird species, and large mammals are also frequently noted by landowners. Rincon Creek is also likely used as a wildlife migration corridor by many wildlife species, although data regarding this issue is lacking. Rincon Creek historically supported a thriving population of steelhead. Additional information regarding the past presence of steelhead within the watershed is provided in Section 5.0.

4.4 FIRE HISTORY

There have been numerous fires that have burned within the boundaries of the Rincon Creek Watershed, as described in Table 4-1 and shown in Figure 4-2. Previous studies have concluded that the 1985 Wheeler fire, which burned approximately 42 percent of the Rincon Creek Watershed, was a catastrophic event that prevented the return of steelhead (MEC Analytical Systems, Inc. 2001). This conclusion was based on the fact that the Carpinteria watershed was also severely burned (30 percent), but steelhead returned to the creek after the fire. It was argued that the fire, combined with the presence of the Highway 101 culvert at Rincon Creek prevented steelhead from recolonizing Rincon Creek. However, it should be noted that landowners and Ed Henke disagreed with the conclusion that steelhead did not occur within Rincon Creek after 1985 (MEC Analytical Systems, Inc. 2001).

Table 4-1: Fire History of the Rincon Creek Watershed

Year	Name	% of Rincon Watershed Burned	Notes
1898	Los Padres	9	Located east of Rincon Creek.
1910	Coyote Creek	5	-
1913	Rincon Creek	19	Occurred somewhat along the creek.
1932	Matilija	48	North half of watershed burned.
1956	La Conchita	4	-
1971	Romero	0.5	-
1985	Wheeler	42	Carpinteria Watershed was also severely burned in this fire (30 percent).
1989	Bates	0.002	-

Source: Santa Barbara County GIS files.

Various landowners have also described a recent fire which occurred in December 1999. This fire was not included in the GIS files provided by Santa Barbara County, and as a result, it is not included in Table 4-1 or Figure 4-2. Landowners indicated that this fire burned approximately 350 acres within the lower watershed.

5.0 PREVIOUS DATA

5.1 WATER QUALITY

5.1.1 Project Clean Water

Santa Barbara County initiated Project Clean Water (PCW) in the fall of 1998 in an effort to improve the water quality in local creeks and in the ocean. The program is fueled by a public concern regarding beach advisories and historic beach closures to elevated bacterial levels, as well as community interest to improve the condition of local creeks. PCW consists of a group of government agencies, community groups, and individuals that work to investigate and implement solutions to contamination in local creeks and the ocean.

PCW completes water sampling at regular intervals within many local creeks. Within Rincon Creek, PCW samples at Bates Road at a location one mile upstream from Highway 150. Previous PCW reports have found indicator bacteria (total coliform, fecal coliform, and enterococcus groups) consistently high at this location (Santa Barbara County 2002). Nitrogen and phosphorus have also been found to be elevated in agriculturally dominated watersheds, which includes Rincon Creek (Santa Barbara County 2002). PCW sampling locations within the watershed are shown in Figure 5-1.

5.1.2 Long Term Ecological Research Project

The Santa Barbara Coastal Long Term Ecological Research Project (LTER) is housed at the University of California, Santa Barbara (UCSB) and is part of the National Science Foundation's (NSF) Long Term Ecological Research Network. The NSF established the LTER program in 1980 to support research on long-term ecological phenomena. LTER is a cooperative data collection effort involving more than 1,800 scientist and students at 26 sites who investigate ecological processes over long temporal and broad spatial scales. The mission of LTER is to “Provide the scientific community, policy makers, and society with the knowledge and predictive understanding necessary to conserve, protect, and manage the nation's ecosystems, their biodiversity, and the services they provide.”

LTER sampling began in Rincon Creek in October 2000 with assistance from UCSB researchers. Studies include the effects of land and ocean pollutants especially the contribution of nutrients (fertilizers) on kelp forests. During storm events, samples are collected around the clock and during dry conditions on a weekly basis. Levels of nitrates and phosphates, common components of fertilizers, ammonium, nitrate (measured as nitrite and nitrate), phosphorus (measured as soluble reactive phosphorus), total dissolved nitrogen, total dissolved phosphorus, particulate organic carbon, total particulate nitrogen, total particulate phosphorus, total suspended sediments, and conductivity are analyzed from the samples (Santa Barbara Coastal Long Term Ecological Research Project 2007). LTER sampling locations within the watershed are shown in Figure 5-1.

5.1.3 Central Coast Ambient Monitoring Program

The Central Coast Ambient Monitoring Program (CCAMP) is the Central Coast Regional Water Quality Control Board's regionally scaled water quality monitoring program and a major portion of its funding comes from Surface Water Ambient Monitoring Program (SWAMP). SWAMP was created by the State Water Resources Control Board (SWRCB) designed to monitor all hydrologic units of the State, document water quality conditions, identify water quality problems, and evaluate the data to protect the waters of the State.

The goal of CCAMP in the Central Coast region is to provide a screening level assessment of water quality in all hydrologic units, based on a variety of chemical, physical and biological indicators in order to enhance the quality of the waters of central California. Monitoring includes conventional water quality and toxicity, sediment chemistry and toxicity, habitat assessment, benthic invertebrate bioassessment, and flow. CCAMP monitors the regions five watershed areas by using a rotating basin approach where conventional water quality monitoring is performed monthly at all sites, and at a subset of the sites other monitoring approaches are performed annually or biannually.

CCAMP water sampling occurs in Rincon Creek at Bates Road, upstream from the Highway 101 culvert. Results have shown water samples from Rincon Creek resulted in toxicity to fathead minnow larvae (*Pimephales promelas*) in both spring and winter samples as well as significantly reduced reproduction of water fleas (*Ceriodaphnia dubia*) in the spring samples. At Rincon Creek the unionized ammonia concentration in the pore water of these samples exceeded Basin Plan criteria and is directly toxic to aquatic life. Survival of the amphipod *Hyallela azteca* was significantly reduced in samples from Rincon Creek. Future CCAMP sampling within Rincon Creek for boron is planned.

5.1.4 Heal the Bay

Heal the Bay is a nonprofit environmental organization dedicated to making Southern California coastal waters and watersheds safe, healthy, and clean by conducting research and educating the community. Heal the Bay has a beach monitoring program, Beach Report Card (BRC), which reports the water-quality information you need to protect your health every time you visit the beach. Monitoring includes sampling the water quality at over 400 beaches from Humboldt County to San Diego County on a weekly basis and reporting a letter grade (A to F). Water samples are analyzed for bacteria that indicate pollution from numerous point and non-point sources, including fecal waste. The higher the grade a beach receives, the lower the risk of illness to ocean users.

Heal the Bay measures the water quality at the Rincon Creek outfall into the Pacific Ocean. BRCs have shown a trend of excellent scores (A^+), with a few poor scores (C, D, F) scattered throughout the winter months of the last 5 years. Heal the Bay does not analyze the BRC data, but as the scores show, lower scores are usually associated with the rainy, winter months.

Additional Rincon Point BRC monitoring sites include the end of the footpath to the beach and 25 yards and 100 yards south of Rincon Creek outfall.

5.1.5 South Coast Watershed Characterization Study

In 1998 the Santa Barbara County Public Health Department initiated the *South Coast Watershed Characterization Study* in order to characterize the water quality of four south coast streams, including Rincon Creek (URS 1999). The study relied upon data from a collection of water samples taken from a minimum of ten locations within Rincon Creek during four sampling events. In Rincon Creek, sampling was conducted during October 1998, November 1998, January 1999, and March 1999. Data collected assessed the levels of coliform, fecal coliform, and enterococcus. General mineral constituents and physical parameters were also recorded at three of the ten sampling locations.

Major findings for Rincon Creek were:

- Nitrate was high as compared to the other three creeks in the study (Mission, Carpinteria, and Arroyo Burro Creeks).
- Nutrient levels were very low, particularly ammonia-nitrogen. This was also found for Carpinteria and Mission Creeks.
- Phosphorus levels were higher in Rincon than the other three creeks.
- Biological Oxygen Demand was low in Rincon and Carpinteria Creeks.
- Metals were not detected (cadmium, chromium, mercury) or were measured at very low levels (copper, nickel, lead, zinc).
- Total suspended sediments varied greatly among dates and sampling locations. Casitas creek had elevated total suspended sediment values, as compared to the upper and lower mainstem of Rincon Creek.
- During the first winter rainfall increases in bacteria concentrations were recorded. Total coliform, fecal coliform, and enterococcus increased several orders of magnitude. Numerous sources of bacteria were found throughout the watershed. No direct link between septic systems and beach closures was established.

5.1.6 Lower Rincon Creek Watershed Study

In 1999, the County of Santa Barbara in cooperation with Heal the Ocean commissioned a study to investigate the source of fecal contamination in the Lower Rincon Creek Watershed using *E. coli* bacteria (Santa Barbara County 1999). There are many issues and limitations to this study, and as a result, the data and conclusions from this study are not included in this watershed plan.

5.2 BIOLOGICAL RESOURCES

5.2.1 Steelhead Data

In 2002, M.W. Stoecker and the Conception Coast Project published the *Steelhead Assessment and Recovery Opportunities in Southern Santa Barbara County, California* (Stoecker *et al.* 2002). The study identified restoration actions for wild, southern steelhead in 24 watersheds and sub-watersheds from Jalama Creek to Rincon Creek. The focus of the study was to identify, prioritize, and develop site-specific recommendations for steelhead migration barriers. Field surveys were conducted to assess the habitat conditions, the current population status, and the location and severity of upstream migration barriers. Data was also collected to determine the historical and contemporary steelhead population status for each watershed. Rincon Creek was determined to have a high quantity and quality of steelhead habitat, which combined to give it the sixth habitat ranking out of the 24 watersheds and sub-watersheds evaluated.

Rincon was given a steelhead status score of 0.9, which indicates that current (2000-2002) salmonid documentation exists for the watershed and adult steelhead have been documented prior to 2000. When the total habitat score was multiplied by the steelhead status score, Rincon Creek was ranked eighth in steelhead recovery priority out of the 24 watersheds and sub-watersheds that were evaluated in the study.

It was the high ranking of Rincon Creek in this study that generated interest in further assessing the steelhead habitat within Rincon Creek. The watershed plan relies upon the steelhead migration barrier data developed by M.W. Stoecker and the Conception Coast Project, and supplements it by collecting additional habitat data and updating the migration data.

Additional information regarding the presence of steelhead within the watershed was compiled from various other sources. One significant source of information was the Center for Ecosystem Management and Restoration (CEMAR). CEMAR is completing a Southern Steelhead Resources Project (SSRP), which is aimed at creating a digitally archived database of information regarding anadromous fish and their habitat in central and southern California. During completion of the watershed plan, CEMAR provided the output of their database for Rincon Creek. Any record within their database that mentioned Rincon Creek was provided. Records included previous stocking reports, studies completed, thesis projects, and agency correspondence.

Table 5-1 describes information collected regarding the presence of steelhead within the Rincon Creek watershed.

Table 5-1: Steelhead Information

Date(s)	Steelhead Status and Records	Source(s)
1930s	Landowners indicated an abundance of steelhead.	Santa Barbara NewsPress 1989.
1940s	In April of 1943 approximately 1,500 trout were stocked in Rincon Creek. In March of 1944 approximately 900 trout were stocked in Rincon Creek. In August of 1944 approximately 2,272 ounces (with an estimated 10 fish to the ounce) or 22,720 total steelhead fry were rescued from the Santa Ynez River and stocked within Rincon Creek. In 1947 approximately 500 trout were stocked in Rincon Creek. Landowners indicated an abundance of steelhead.	CDFG 1943, 1944a, 1944b, 1947. Santa Barbara NewsPress 1989.
1956-57	Arve Sjovold stated, "Rainbow trout were present in the first pool on Catharina Creek, just upstream from the Rincon Creek confluence. A waterfall approximately 6 to 8 feet tall existed at the upstream end of this first pool that apparently prevented upstream migration as no rainbow trout were observed upstream."	Stoecker *et al.* 2002.
1959-1963	Dr. Walter Barrows indicated that from 1959-1963 his children were catching small juvenile steelhead (up to 12 inches) out of Rincon Creek along their property line.	Letter from Ed Henke to Eric Schott (NOAA) 1998.
1960s	In 1963 juvenile steelhead were observed near the Barrows property. In 1969 trout were stocked. Landowners indicated a decrease in the population in the early 1960s.	MEC Analytical Systems, Inc. 2001. Letter from Ed Henke to Eric Schott (NOAA) 1998. Stoecker *et al.* 2002.
1970s	Ken Sasaki (former CDFG regional biologist) reported observing rainbow trout in Rincon Creek along Stanley Park Road in the 1970s.	Stoecker *et al.* 2002.
Pre-1985	Arve Sjovold (resident and angler) stated that, "Prior to the 1985 Wheeler fire, rainbow trout were observed upstream of the quarry site (R_11*), although the population size was smaller than before the floods of 1969. Since the 1985 fire, no more observations of rainbow trout have been made in three outings upstream of the quarry site."	Stoecker *et al.* 2002.
1990s	CDFG surveys in 1993 found no fish. USFS surveys in 1994 found no fish. From 1995 to 1997 landowners observed juvenile steelhead near the Barrows property.	MEC Analytical Systems, Inc. 2001. Letter from Ed Henke to Eric Schott (NOAA) 1998.
2000	Chuck Cesena (Caltrans) observed one trout downstream of the most downstream Highway 150 bridge. Surveys conducted by USFS find no fish in Rincon Creek and note that high sedimentation occurs downstream from the confluence with Casitas Creek.	Stoecker *et al.* 2002. USFS 2000.
2001	Landowner stated regularly observes trout (up to 9 inches) in the pool downstream of R_2*.	Stoecker *et al.* 2002.
2001	M.W. Stoecker observed 2 trout (5-6 inches). One observed upstream from R_4*, one observed upstream of R_9*.	Stoecker *et al.* 2002.
2005	During the rains of 2005, two bridges on Highway 150 were washed out. During that time one trout was observed in Rincon Creek.	Cesena 2006.

Note: *Barriers have been renumbered to reflect current conditions.

5.2.2 Additional Biological Resources Data

The Rincon Creek watershed is used by a variety of wildlife species. Previous surveys conducted by UCSB between 1988 and 1991 found that 81 bird species were present within the watershed (MEC Analytical Systems, Inc. 2001). Other species commonly observed include raccoons, bears, coyotes, tree frogs, newts, and southwestern pond turtles. Anecdotal reports of use by bobcats have also been reported (MEC Analytical Systems, Inc. 2001). Special-status species that have been previously documented within the watershed are listed in Table 5-2. The watershed could also support several other special-status species. The information presented in this section is not intended to be a comprehensive species list.

Table 5-2: Special-Status Species Previously Observed

Name	Status	Source(s)
Birds		
Yellow-breasted chat	CSC	MEC Analytical Systems, Inc. 2001
Yellow warbler	CSC	MEC Analytical Systems, Inc. 2001
Fish		
Southern steelhead	FE	Various
Reptiles		
Southwestern pond turtle	CSC	Cardenas 1999
Invertebrates		
Monarch butterflies	Monitored by the CNDDB.	CNDDB 2006

Notes: CNDDB=CDFG Natural Diversity Database.
Status codes: FE=Federally Endangered. CSC=California species of special concern.

6.0 FIELD SURVEY

In May 2006 a field survey was conducted within Rincon and Casitas Creek in order to gather additional data regarding the baseline condition of the watershed. This section describes the field survey methods and data analysis methods. The results are presented in Section 7.0. It should be noted that the data collected during May 2006 represent the field conditions at the time of the survey and for some issue areas, long-term data is needed.

6.1 PARTICIPANTS

The survey team consisted of personnel from Tetra Tech, PWA, and the CEC. The Cachuma RCD also assisted on the first day of surveying. A few landowners also accompanied the field crew during portions of the survey. The area surveyed is shown in Figure 1-1.

6.2 FIELD METHODOLOGY

After examining existing data gaps, it was determined that field work for the watershed plan would include the following elements to supplement existing data:

- An assessment of habitat quality for steelhead.
- An assessment of non-native, invasive plant species.
- A geomorphic assessment to investigate erosion/sedimentation issues in the watershed.

Each of these components is described in more detail below.

6.2.1 Steelhead Habitat Assessment

To assist in developing the Rincon Creek Watershed Plan it was critical to determine (1) the amount of and quality of adult steelhead habitat that exists, (2) the amount of degraded steelhead habitat for spawning and rearing, and (3) the potential causes of degraded habitat quality.

Field sampling methods were developed based on the CDFG's *California Salmonid Stream Habitat Restoration Manual* (Flosi *et al.*1998 as amended). These standard methods were used so that data can be reproduced, to monitor the progress of restoration efforts within the watershed. The project team started at the mouth of Rincon Creek and worked their way up the watershed. The field survey was conducted up to the location of the rock quarry, which represents the current limit of anadromy.

An initial site visit indicated that riffle habitat would likely dominate the lower watershed. Instead of sampling every tenth habitat unit as described in the *California Salmonid Stream Habitat Restoration Manual* (Flosi *et al.*1998 as amended), it was determined that a complete sample would be collected every 150 meters (see Table 6-2 below). This method ensured that adequate sampling data would be collected within the lower watershed.

Each habitat unit was identified, numbered, and classified by habitat type. Within the lower watershed, a complete sample of the habitat type that occurred every 150 meters was collected. A complete sample was also collected within each pool of the lower watershed. When a complete sample was taken in pools, the 150 meters was restarted.

In the upper watershed, pool habitats became much more common. The field methods were modified in the upper watershed so that a complete sample was taken every 150 meters. Complete samples were not taken in every pool that occurred in the upper watershed.

Table 6-1 presents the measurements that were taken for each habitat unit. A more detailed description of each habitat parameter and how each measurement was taken in the field are also provided below.

Table 6-1: Habitat Measurements Taken for Every Habitat Unit

Data Recorded
Stream Name, Date, Surveyors' Names, Time
Habitat Unit Start Distance (m)
Habitat Unit End Distance (m)
Habitat Unit Number
Habitat Unit Type
GPS Waypoint
Right Chanel or Left Channel
Maximum Water Depth (cm)
Notes

Table 6-2 presents the measurements that were taken for a complete sample, which was taken every 150 meters and in all pool habitats in the lower watershed and every 150 meters in the upper watershed.

Table 6-2: Habitat Measurements Taken for a Complete Sample

Data Recorded
Stream Name, Date, Surveyors' Names, Time
Habitat Unit Start Distance (m)
Habitat Unit End Distance (m)
Habitat Unit Number
Habitat Unit Type
GPS Waypoint
Right Channel or Left Channel
Maximum Water Depth (cm)
Substrate Type (%)
Embeddedness (%)
Presence of Spawning Gravel? (Y or N)
Instream Shelter Percent Unit Covered (%)
Percent Canopy Density (%)
Dominant Riparian Vegetation
Bank Stability
Presence of Fish
Notes

Detailed descriptions of the measurements listed in Tables 6-1 and 6-2 are provided below.

- **Habitat Unit Start Distance.** Total upstream distance at start of a habitat unit; measured in meters.

- **Habitat Unit End Distance.** Total upstream distance at end of a habitat unit; measured in meters.

- **Habitat Unit Number.** The first habitat unit was labeled habitat unit 1 and subsequent habitat units were labeled sequentially.

- **Habitat Unit Type.** The habitat type was first determined using a standardized methodology that physically describes 100 percent of the wetted channel. The habitat type was identified as a riffle (RIF), cascade (CAS), flatwater (FLAT), or pool (POOL). Flatwater are stream habitats that include very little turbulence or white water. This includes glides, pocket water, runs, or edge water. All pools were then distinguished further into the type of main channel pool, scour pool, or backwater pool. Pools are defined as having little or no flow and a volume controlling feature. The length of the pool must be at least one half the wetted channel width in order to be considered a pool. Barriers were treated as a habitat unit type (BAR).

RIFFLE	
Low Gradient Riffle	LGR
Hight Gradient Riffle	HGR
CASCADE	
Cascade	CAS
Bedrock Sheet	BRS
FLATWATER	
Pocket Water	POW
Glide	GLD
Run	RUN
Step Run	SRN
Edgewater	EDW
MAIN CHANNEL POOL	
Trench Pool	TRP
Mid-Channel Pool	MCP
Channel Confluence Pool	CCP
Step Pool	STP
SCOUR POOL	
Corner Pool	CRP
L. Scour Pool - Log Enhanced	LSL
L. Scour Pool - Root Wad Enhanced	LSR
L. Scour Pool - Bedrock Formed	LSBk
L. Scour Pool - Boulder Formed	LSBo
Plunge Pool	PLP

BACKWATER POOLS	
Secondary Channel Pool	SCP
Backwater Pool - Boulder Formed	BPB
Backwater Pool - Root Wad Formed	BPR
Backwater Pool - Log Formed	BPL
Dammed Pool	DPL

- **GPS Waypoint.** A global positioning system (GPS) data point was collected at the beginning of each habitat unit. The corresponding filename was recorded.

- **Right Channel or Left Channel.** The channel surveyed for habitat measurements was recorded. Right and Left are relative to walking up the stream from the Pacific Ocean.

- **Maximum Water Depth.** Using a polyvinyl chloride (PVC) measuring rod, the maximum water depth was measured in each habitat unit.

- **Substrate Type.** The percent bed composition of each substrate type was recorded at the beginning distance of the habitat unit. For pools, the substrate composition at the pool tail (downstream end of pool) was recorded. The percentage silt/clay, sand (diameter less than 0.08 inches), gravel (diameter 0.08 to 2.5 inches), cobbles (diameter 2.5 inches to 10 inches), boulders (diameter greater than 10 inches), bedrock, or concrete (if the creek is channelized) was estimated by eye.

- **Embeddedness.** The percent embeddedness, or the degree which substrate is clogged with silt and fines at the bed's surface, was estimated to the nearest 10 percent by eye at the beginning distance of the habitat unit.

- **Presence of Spawning Gravel?** If any spawning gravel was present throughout the habitat unit, it was recorded regardless of whether it was the dominant substrate, and regardless of embeddedness. Spawning gravel is defined as a specific size of gravel, between pea-size and golf ball size. Highly consolidated substrate (substrate that is cemented together and cannot be easily separated) was not counted as spawning gravel.

- **Instream Shelter Percent Unit Covered.** The percentage of the wetted width of the habitat unit that was covered by shelter was recorded and each feature that provides shelter in that habitat unit was recorded. Example features include undercut banks, small woody debris (diameter less than 12 inches), large woody debris (diameter greater than 12 inches]) or large deposits of small wood compiled into a large snag, willow root masses, emergent vegetation (any vegetation with roots anchoring it to the stream bottom), floating aquatic vegetation, floating algae/diatoms, bubble curtains (white water turbulence that is significant enough to obscure the presence of fish below), boulders (that provide escape cover), and bedrock ledge undercuts.

- **Percent Canopy Density.** While standing at the beginning distance of the habitat unit in the center of the wetted width the percent canopy density (shade over the stream) was estimated using a spherical densiometer.

- **Dominant Riparian Vegetation.** The following was recorded: N if the dominant riparian overstory within the habitat unit was native; A if the dominant overstory vegetation was *Arundo* *donax;* E if the dominant overstory vegetation was eucalyptus; O if the dominant overstory was some other non-native species (e.g., Cape ivy).

- **Bank Stability.** The following was recorded: S if the bank stability within the habitat unit was visually stable. A if the bank stability within the habitat unit was armored. U if the bank stability within the habitat unit was unstable.

- **Presence of Fish.** If fish were present, they were noted as: N = presence of trout or chub; I = presence of invasive, non-native fish species such as mosquitofish, carp, sunfish, etc.

- **Notes.** Notes of landmarks, disturbances, any artificial bank stabilization structures or in-stream structures and photo numbers were recorded.

6.2.2 Steelhead Upstream Migration Barriers

Previous steelhead habitat data exist in the *Steelhead Assessment and Recovery Opportunities in Southern Santa Barbara County, California* (Stoecker *et al.* 2002). However, since the time of this report, two barriers to fish passage (two Highway 150 bridges) were washed out. The bridges were replaced by Caltrans and no longer represent barriers to steelhead upstream migration. During the field survey of May 2006, new habitat data for the Highway 150 bridges was collected. Other barriers that were previously assessed by Stoecker *et al.* 2002 were not reassessed during May 2006.

6.2.3 Physical Measurements

Field meters were also used to conduct one time measurements of the pH, temperature, dissolved oxygen (DO), and turbidity within each pool identified during the field survey. Turbidity was measured in Nephelometric Turbidity Units (NTUs), which is a measure of the clarity of the water. The field meter calculated the NTUs of a water sample by determining the amount of light that is reflected off of particles in the water sample. This measurement typically is considered to estimate the amount of total suspended solids in the water sample.

6.2.4 Assessment of Non-native, Invasive Plant Species

The field crew collected a GPS point at the locations with large areas covered by invasive non-native species (e.g., ivy, nasturtium). For each stand, a qualitative description of the occurrence of non-native species was made which included the species present and the side of the bank that it is located (while looking upstream).

6.2.5 Riparian Corridor

During the field survey, long stream reaches lacking a riparian corridor were noted. In these areas, the reason for the lack of riparian vegetation was noted (rip-rap, etc.), the length of the reach without riparian vegetation was measured, and GPS data was collected.

6.2.6 Field Observations

During the field survey, any wildlife observed by sight, sound, or sign (tracks, scat) were noted. Additional notes were taken regarding any unusual features, like the presence of debris, oil and tar deposits, areas with buildings, etc.

6.2.7 Geomorphic Assessment

PWA completed a geomorphic reconnaissance of the study reaches along Rincon and Casitas Creeks in May of 2006. The purpose of the geomorphic survey was to gain an understanding of the channels, evaluate the stability of bed and banks in the study area, and identify bank erosion “hot spots”. The geomorphic survey was undertaken by walking the study reaches, which consisted of Rincon Creek from the mouth upstream to the rock quarry and Casitas Creek from the confluence upstream to the Loncado Corps property.

During the field phase, PWA physically evaluated detailed geomorphic conditions at select channel reaches. The field assessment integrated field protocols from several channel assessment methods, including:

- **PWA Hydromodification Assessment** – PWA collected data to support a modified version of their Contra Costa County Hydromodification Method, which has been peer reviewed by the San Francisco Bay RWQCB. The method involves measuring primary factors influencing channel stability that include the entrenchment ratio (as defined by Rosgen), and an entrainment ratio (estimated average boundary shear stress divided by critical shear stress of the channel materials). The secondary factors are: width:depth ratio, valley confinement class, active bank erosion, active sediment supply, bed materials, bank materials and average channel slope.

- **Site-Specific Issues** – PWA identified site-specific erosion and/or sedimentation issues that deserve special attention. PWA mapped these sites using GPS and field maps. PWA also identified conceptual ideas for addressing and/or protecting these sites.

During the field survey, PWA took quantitative measurements of the width (bankfull), depth (bankfull), valley width at twice bankfull depth, median bed particle size (D50), channel slope, pool fine sediment depth, residual pool depth, pool frequency. PWA also qualitatively characterized the active bank erosion, active sediment supply, dominant reach-scale grain size class, channel class, bed surface grain and particle size distribution patterns, gravel bar distribution, channel pattern, floodplain pattern, general channel roughness, hillslope sediment sources. All sites were photographed and their locations were determined using a GPS.

6.3 DATA ANALYSIS

6.3.1 Steelhead Habitat Assessment

All field data was entered into an Excel database and summary statistics were calculated to evaluate steelhead habitat quality as shown in Table 6-3. The mainstem of Rincon Creek and Casitas Creek were divided into stream reaches, for which the summary statistics were calculated.

Average steelhead habitat quality was determined by using four habitat components:

- Pools/habitat type;
- Substrate;
- Instream shelter; and,
- Canopy closure.

Each of these four habitat components were evaluated using the habitat suitability criteria that are presented in Table 6-4. Habitat data were assigned a rating of excellent, very good, good, fair, or poor in terms of pools/habitat type, substrate, instream shelter, and canopy closure for adult steelhead. If a rating fell in between two habitat quality rating values, the higher (the more optimal) of the two values was assigned to that stream reach (i.e., if a value falls between excellent and very good, the reach was assigned excellent). The results of the habitat quality ratings for each watershed were mapped.

Table 6-3: Habitat Summary Statistics

Summary Statistics	Stream Segment 2 (HU 4 to HU 26)	Stream Segment 3 (HU 27 to HU 41)
Stream Length Surveyed (m)	852.4	681.5
Dominant Habitat Unit Type	LGR	LGR
Percent of Habitat Units that are Pools (%)	4	19
Total Length of Habitat Units that are Pools (m)	4.6	50.6
Percent of Total Length that are Pools (%)	0.5	7
Average Max. Water Depth (cm)	40	44
Average % Bedrock	0	0
Average % Boulder	9	18
Average % Cobble	24	28
Average % Gravel	44	23
Average % Sand	19	10
Average % Silt/Clay	4	18
Average % Concrete	0	0
Dominant Substrate Type	Gravel	Cobble
Average Embeddedness (%)	17	21
Percent of Habitat Units Surveyed with Spawning Gravel (%)	100	100
Average Percent Instream Shelter (%)	20	19
Average Percent Canopy Closure (%)	52	26

Notes: These statistics were calculated for all surveyed reaches within Rincon and Casitas Creeks, data for only two reaches are shown for illustration purposes. HU=Habitat Unit number, m=meters, cm=centimeters.

Table 6-4: Habitat Suitability Criteria

Habitat Parameter	Excellent	Very Good	Good	Fair	Poor	Primary References
Pools/Habitat Type						
Habitat Type						
Adults	Mid-channel pools	Runs/ glides, step runs	Scour pools	Backwater pools	Low and high gradient riffles	1, 3, 5, 6, 9
Juveniles	Low and high gradient riffles	Runs/ glides, step runs	Mid-channel pools	Scour pools	Backwater pools	1, 5, 6
Max. Pool Depth (cm)						
Adults	>80	60-80	40-60	20-40	0-20	1, 3, 6, 7, 8
Juveniles	>30	20-30	10-20	5-10	0-5	1, 3, 6, 8
Percent Pools (% of survey length)	70	50-70	30-50	20-30	<20 or >70	2, 8, 10
Substrate						
Percent Habitat Units with Spawning Gravel (% of habitat units in survey length)	>3	2-3	1-2	<1	0	1, 2, 3, 4, 6, 7, 10
Percent Embeddedness	<25	25-30	30-40	40-50	>50	1, 2, 4
Dominant Substrate	Gravel	Cobble	Boulder	Sand	Silt/Clay	1, 4, 8, 10
Percent Silt/Clay	<11	12-13	14	15-16	>16	11
Instream Shelter						
Instream Shelter Percent	>80	60-80	40-60	20-40	0-20	3,4
Canopy Closure						
Percent Canopy Closure	80-100	60-80	40-60	20-40	0-20	1, 8

Primary technical references cited in table:

1. Dagit *et al.* 2003; Dagit *et al.* 2004
2. Lousiana Pacific 1996
3. Flosi *et al.* 1998 as amended
4. Spina 2003
5. McEwan and Jackson 1996
6. Moyle 2002
7. Reiser and Bjornn 1979
8. NMFS 1997
9. Shapavalov and Taft 1954
10. Raleigh *et al.* 1984
11. Peterson *et al.* 1992

6.3.2 Steelhead Upstream Migration Barriers

An analysis of upstream migration barriers for steelhead was conducted by mainly relying upon the results reported in the *Steelhead Assessment and Recovery Opportunities in Southern Santa Barbara County, California* (Stoecker *et al.* 2002). The information provided in this report was updated and augmented by field observations made during the May 2006 survey.

6.3.3 Physical Parameters

During the May 2006 survey, pH, DO, temperature, and turbidity were measured using field meters. These values were measured at 48 locations in Rincon Creek and 9 locations within Casitas Creek, as shown in Figure 6-1. Average values were calculated for defined stream reaches. The data was compared to other streams in southern California that are known to support current steelhead populations.

6.3.4 Non-native, Invasive Plant Species Assessment

As the field survey was conducted, major stands of non-native, invasive plant species were identified and GPS points were collected. This data was then mapped using GIS.

6.3.5 Riparian Corridor

Long stretches of the stream that lacked an intact riparian corridor were mapped. Maps also categorized the types of land uses that are present in these areas (rip-rap, avocado trees, etc.).

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7.0 BASELINE WATERSHED CONDITION

7.1 LAND USE

A small lagoon occurs at the mouth of Rincon Creek. The lagoon size varies by rainfall, tidal influx, and season. As described in Section 4.0, the lagoon has been narrowed over time. Both sides of the lagoon are within the Rincon Point Homeowners Association. There are 64 single family residences and 8 townhouses within this residential area. Rincon Point is a famous surf spot that is located on the rocky point within Ventura County. The Santa Barbara County side of the creek mouth is characterized by a long, sandy beach.

The 101 Highway arch culvert is located 190 meters upstream from the ocean. From the 101 culvert upstream to the Casitas Creek tributary, the land use is dominated by agricultural uses and scattered residences occur. Avocado orchards are the major agricultural use within the watershed, although there are small amounts of other crops (lemons, etc.). A few small agricultural growers are currently certified organic growers or are in the process of becoming certified organic growers.

The mainstem of Rincon Creek enters the Los Padres National Forest upstream of the confluence with the Casitas Creek tributary. Upstream from this point, the creek is dominated by agricultural uses and scattered residences, as well as open space. Two small tributaries, Laguna Creek and Sulfur Creek, branch to the east of the mainstem upstream from the Casitas Creek tributary. Upstream from Sulfur Creek is an abandoned rock quarry. The rock quarry stretches for an estimated length of 550 meters. In the upper watershed above the rock quarry, the land use is a mixture of agriculture (avocado trees) and open space. Several smaller tributaries occur above the rock quarry, to the east and west of the mainstem. Catherina Creek is one of the larger of these tributaries and it branches to the east of the mainstem.

Current zoning designations within the watershed are listed in Table 7-1. Although the Santa Barbara County and Ventura County zoning designations differ, they were grouped into general land use categories. Zoning designations are mapped in Figures 7-1A and 7-1B. Both Ventura and Santa Barbara Counties have designated the riparian corridor of Rincon Creek as an Environmentally Sensitive Habitat Area.

Table 7-1: Zoning Designations

Zoning Designation	Santa Barbara County (acres)	Ventura County (acres)	Total (acres)	percent
Residential	96	90	186	2
Recreation	1	-	1	0
Transportation	4	-	4	0
Agriculture	691	-	691	7
Mountainous (Open Space)	1,210	7,262	8,471	91
Totals	**2,001**	**7,352**	**9,352**	**100**

Sources: Santa Barbara County acreages were calculated based from GIS files. Ventura County acreages were estimated based on hard copy maps within the Ventura County General Plan. The Santa Barbara County GIS files indicate a total watershed size of 9,352 acres. Ventura County agricultural land was included within the Mountainous (Open Space) category.

The *Steelhead Assessment and Recovery Opportunities in Southern Santa Barbara County, California* (Stoecker *et al.* 2002) also included an analysis of the land use within the Rincon Creek watershed. Landsat 7 ETM satellite imagery was collected in September 1999 and used to differentiate and map types of land cover and land use (Stoecker *et al.* 2002). The results of this analysis are presented in Table 7-2.

Table 7-2: Land Use Characteristics

Road Length (miles)	Area Roaded (mi/mi2)	Urban & Impervious (percent)	Irrigated Agriculture (percent)	Shrub/ Scrub (percent)	Chaparral/ Woodland (percent)	Chaparral/ Forested (percent)	Grassland (percent)	Disturbed (percent)
57.9	4.0	1.2	10.5	4.6	31.3	49.1	2.6	0.7

Source: Stoecker *et al.* 2002.
Note: Stoecker *et al.* 2002 used a total watershed size of 9,304 acres to calculate the percentages shown.

7.1.1 Interviews of Agricultural Growers

On January 31, 2007, Tetra Tech and CEC interviewed four agricultural growers within the watershed. The purpose of the interviews was to gain a better understand of the agricultural practices that are currently used in the watershed. Information on their growing practices (use of fertilizers, amount of ground disturbance, weed-control activities, etc.), future plans for their property, crop loss during the severe weather of January 2007, and their main concerns was gathered and is summarized below.

The landowners interviewed grow avocados and lemons primarily, although smaller amounts of other crops are also grown. Avocado trees are watered using drip irrigation and no ground disturbing activities are performed under the avocado trees. Pests were cited as a concern by several of the growers and spraying of pesticides by helicopter is performed by some of the growers. In some parcels, road maintenance is performed by tractors and excavators. Some dirt roads are accessible by all terrain vehicles (ATVs) only. Some of the growers within the watershed are currently organic farmers; others are in the process of converting to organic farming. Main concerns that were raised by the landowners interviewed include:

- Loss of land due to landslides and erosion.
- Crop damage from pests.
- Weeds, such as giant reed and Cape ivy.
- Crop losses due to recent weather (see Section 7.9.2).
- The need for a buffer between the creek and any activities.

All of the landowners interviewed indicated that they have no future plans to expand their agricultural activities.

7.2 CLIMATE AND HYDROLOGY

The climate in the region, which lies in a transitional area between the Pacific Ocean and the inland desert, is influenced by several characteristic air masses. To the west, marine air over the Pacific Ocean exerts a major influence as a large high-pressure cell. This high-pressure cell tends to block storm systems approaching the area from the west, causing them to move well to the north. A persistent inversion layer (warm air above cold air) accompanies the high-pressure cell. A second major air mass region lies over the desert areas to the east and south. The generally warm conditions over the desert cause the near-surface air to rise due to the intense heating near the ground. This produces low atmospheric pressure, which tends to draw in surrounding air, including eastern-moving marine air (the sea breeze) near the coast.

The Rincon Creek watershed is characterized by a semi-arid Mediterranean climate with seasonal rainfall mostly occurring between November and April. Although thundershowers occur during the summer months in the mountains, they do not substantially contribute to annual rainfall amounts. Average rainfall is 18 inches along the coast and approximately 22 inches in the mountains to the east (Western Regional Climate Center 2007). There are several hourly gauges in the area that have been in operation since May 1998. These are NOAA gauges and include Montecito, Old Man Mountain, Carp Fire station, La Cumbre Peak, and Upper Mat Canyon locations. The Mediterranean climate contributes to high erosion potentials, as rainfall is low enough to limit ground cover but can occur with sufficient intensity to cause overland flow and large flood peaks.

There are no stream gauges in the Rincon Creek watershed. However, the adjacent Carpinteria Creek has been gauged by US Geological Survey since 1941 (USGS Station 11119500). The drainage area at the gauge is 13.1 square miles. Since the elevation, geology, climate, and landuse conditions are similar in both watersheds, this data record can be extrapolated to Rincon Creek based on relative watershed area (watershed area of 16 square miles).

Flood frequencies along Carpinteria Creek were estimated to approximate flows along Rincon Creek. Using a proportionality constant of 1.2 to adjust for the larger watershed area, flood frequencies from Carpinteria Creek were adjusted to estimate the respective flows along Rincon Creek. Based on the gauge record, it was estimated that the 100-year flow (flow that has a 1 percent chance of happening in any given year) is approximately 14,500 cubic feet per second (cfs). In 2005 FEMA updated its flood hazard studies for the Santa Barbara County. Figure 7-2A for Santa Barbara County and Figure 7-2B for Ventura County illustrate that almost all areas adjacent to Rincon Creek are mapped as flood hazard areas subject to inundation by the 100-year flood. The FEMA model also indicated that the Highway 101 culvert has insufficient capacity to carry the 100-year flood and that a breakout will occur at the upstream culvert entrance. FEMA used a 100-year flood discharge of approximately 10,000 cfs and estimated that the conveyance capacity of the culvert was approximately 8,500 cfs.

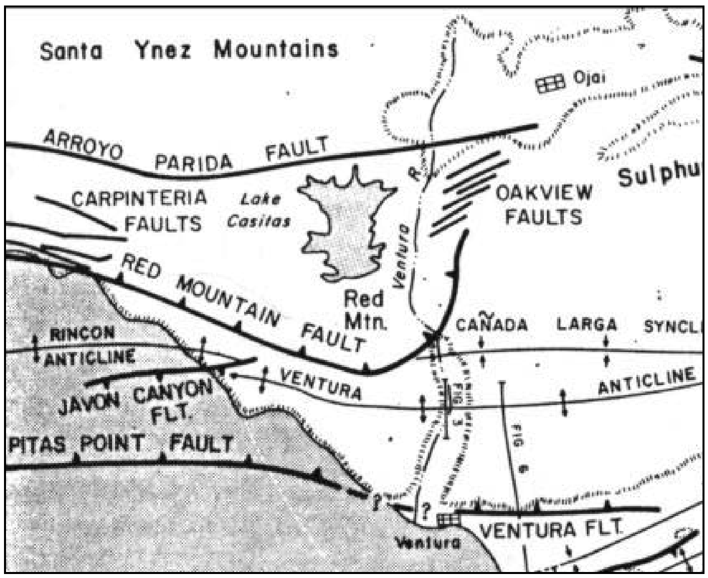
Carpinteria Creek flows were also used to estimate the 2-year recurrence interval flow in the Rincon watershed. Studies of bankfull discharge (sometimes equated with the dominant discharge) in different environments have frequently found it to coincide with flows around the 2-year recurrence interval (ranging from 1.0 to 2.5 years). The 2-year flow was estimated to compare the bankfull depths observed in the field to those predicted by flood frequencies and to gain an understanding of geomorphically significant flows in the watershed. The 2-year flow was estimated as approximately 500 cfs. Assuming average values of roughness and width (derived from a relatively straight section downstream of Casitas Creek confluence), and a slope of 1.4 percent extracted from the HEC-RAS model (developed before the construction of Highway 150 bridges), it was estimated that the 2-year discharge would correlate to a depth of approximately 3 feet. Field estimates of bankfull depths downstream of Casitas Creek ranged from 2.7 to 3 feet. The convergence of estimates suggests that 1) the bankfull depth in the middle reaches of Rincon Creek is approximately 3 feet; 2) the use of Carpinteria Creek data is appropriate and provides an indication for the geomorphically significant flows in the watershed.

7.3 GEOLOGY AND SOILS

The Rincon Creek watershed is a tectonically active and geologically complex system. It is located in an area where rapid uplift, folding, and faulting of the rocks are on-going. Based on an analysis of soil samples, Sylvester and Brown 1988 estimated that uplift rates in this area are approximately 4.2 to 5 meters per 1000 years, which is one of the fastest rates in the world.

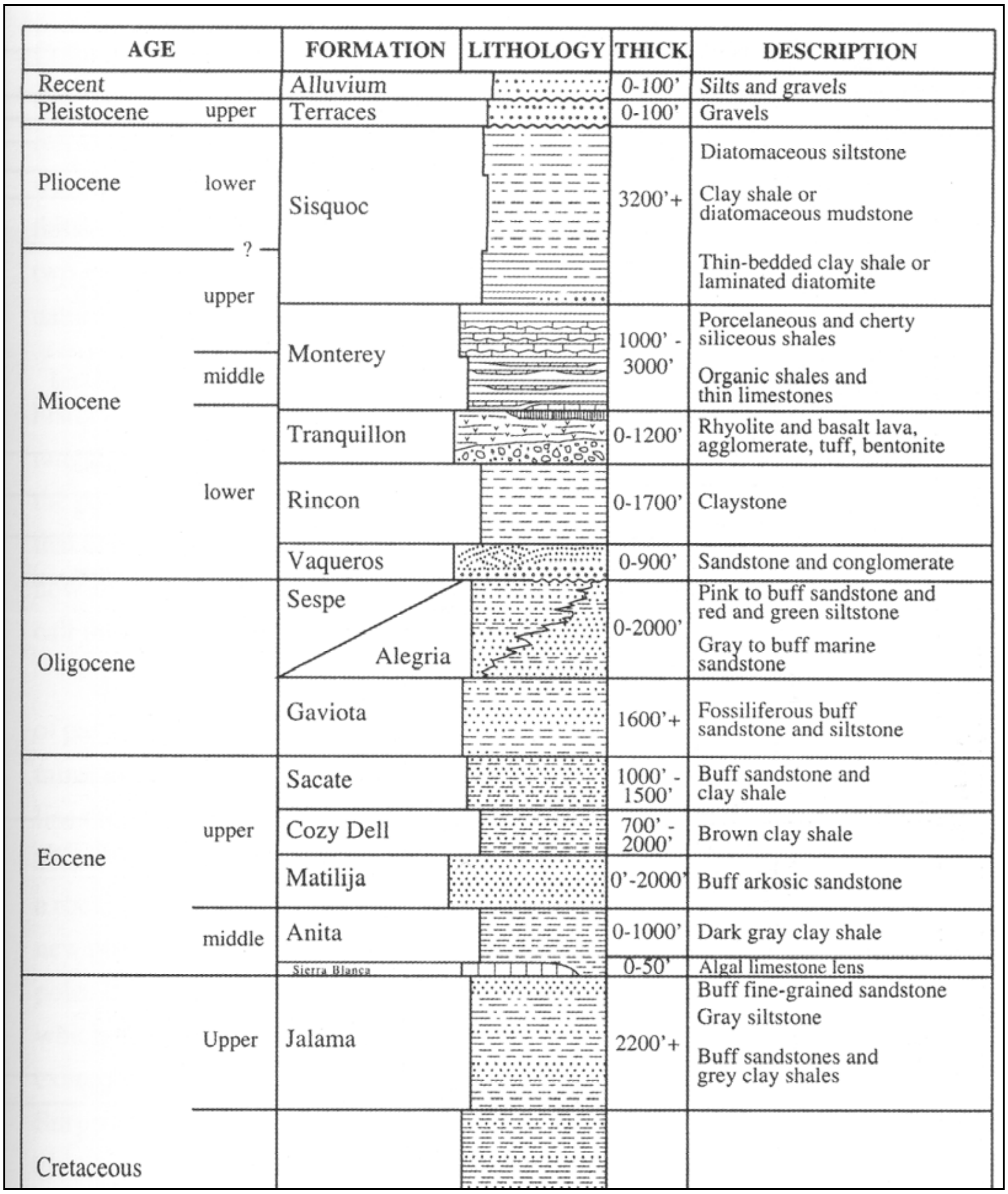
The Rincon Creek watershed is at the junction of southern Coast Ranges and Santa Ynez Mountains of the Transverse Ranges. The Santa Ynez Mountains are an east-west rending range with a single, well-defined crest defined by the Santa Ynez Fault. Around Rincon Creek, the inclination of the rock layers on the south face of the Santa Ynez range are steep and overturned, dipping northward into the mountains (the Montecito overturn). Therefore, the older rocks appear to rest on the younger ones, opposite to the order in which they were originally deposited (Norris 2003).

Rincon Creek flows across several active faults. Arroyo Parida fault crosses through a point 1.5 miles inland from where Highway 150 crosses Rincon Creek (Graphic 7-1).



Graphic 7-1: Fault Lines Near Rincon Creek
Source: Adapted from Sylvester and Brown.1988.

The landscape in the watershed has developed on sedimentary rocks. The sedimentary rocks in the watershed were originally loose sand, soft mud or gravel deposited on the sea floor. Some of the sediments were deposited on land in streams or lakes. Due to the mixture of rock types, the hillsides are often dotted with numerous irregular outcrops and bare rocks composed of the more resistant rock types such as sandstones. Adjacent to these bare outcrops are layers of shale and mudstone that form swales and have smoother slopes. The columnar section in Graphic 7-2 shows the age order and relative thickness of the rock units. It represents the sequence of rock layers present in the area, in stratigraphic order.



Graphic 7-2: Rock Layers Near Rincon Creek

Rocks in the Rincon Creek watershed mostly consist of Eocene sandstones. The upstream Rincon watershed is mostly underlain with Matilija, Cozy Dell and Coldwater formations. The Matilija and Coldwater formations are the source of the huge sandstone boulders that are so prominent in Rincon Creek (Norris 2003). Rocks east of the highway around Rincon Creek are parts of the Sisquoc and Monterey formations. The hills flanking Rincon Creek near its junction with Casitas Creek expose younger deposits of Pleistocene age Casitas Formation.

Casitas Creek watershed is underlain by Oligocene sandstones and siltstones of the Sespe formation. The Sespe formation ranges in age from about middle Eocene through the Oligocene to early Miocene. The older, lower formations of the Casitas watershed are the ones characterized by sediment-choked braided stream and delta deposits. Rocks in the Casitas Creek watershed are younger and primarily consists of less resistant materials (such as siltsones and mudstones compared to the primarily sandstones along the mainstem of Rincon Creek). Therefore, Casitas Creek geology is more susceptible to erosion.

Soils in the Rincon and Casitas Creek watersheds are derived from the erosion of sandstones and siltstones underlying the basins. The soils in the Rincon Creek area consist of loams and sandy loams with medium runoff characteristics and moderate erosion hazard. Casitas Creek watershed soils are primarily shaly loams, loams, and clay loams with rapid runoff characteristics and severe erosion hazard. Overall, soils in the Casitas watershed are more erodible than those in Rincon watershed.

Soils within the watershed are mapped within Figures 7-3A and 7-3B and described in Tables 7-3, 7-4, and 7-5.

Table 7-3: Los Padres Soils

Map Unit Symbol	Map Unit Name
9	Inks-Lodo-Agua Dulce families complex, 30 to 80 percent slopes
26	Millerton-Millsholm families-Rock outcrop complex, 30 to 80 percent slopes
17	Lodo-Livermore-Chualar families association, 30 to 60 percent slopes
42	Rincon-Modesto-Los Osos families association, 30 to 60 percent slopes

Table 7-4: Santa Barbara County Soils

Map Unit Symbol	Map Unit Name
Rb	Rock outcrop-Maymen colmplex, 75 to 100 percent slopes
LbG	Lodo-Rock outcrop complex, 50 to 75 percent slopes
LcG	Lodo-Sespe complex, 50 to 75 percent slopes
PA	Pits and Dumps
MeD2	Milpitas-Positas fine sandy loam, 9 to 15 percent slopes, eroded
BaC	Ballard fine sandy loam, 2 to 9 percent slopes
EaB	Elder sandy loam, 2 to 9 percent slopes
GcC	Goleta fine sandy loam, 2 to 9 percent slopes
MdE	Milpitas stony fine sandy loam, 15 to 30 percent slopes
MdF	Milpitas stony fine sandy loam, 30 to 50 percent slopes
MeC	Milpitas-Positas fine sandy loams, 2 to 9 percent slopes
MeD2	Milpitas-Positas fine sandy loam, 9 to 15 percent slopes, eroded
MeE2	Milpitas-Positas fine sandy loams, 15 to 30 percent slopes, eroded
MeF2	Milpitas-Positas fine sandy loams, 30 to 50 percent slopes, eroded
OAG	Orthents, 50 to 75 percent slopes
XA	Xerorthents, cut and fill areas
ZaD2	Zaca clay, 9 to 15 percent slopes, eroded

Table 7-5: Ventura County Soils

Map Unit Symbol	Map Unit Name
AcC	Anacapa sandy loam, 2 to 9 percent slopes
BdG	Badland
CaF	Calleguas shaly loam, 30 to 50 percent slopes
ChD2	Chesterton coarse sandy loam, 5 to 15 percent slopes, eroded
CyC	Cropley clay, 2 to 9 percent slopes
DbD	Diablo clay, 9 to 15 percent slopes
DbE	Diablo clay, 15 to 30 percent slopes
DbF	Diablo clay, 30 to 50 percent slopes
GxG	Gullied Land
HuC2	Huerhuero very fine sandy loam, 5 to 9 percent slopes, eroded
LeD2	Linne silty clay loam, 9 to 15 percent slopes, eroded
LeE2	Linne silty clay loam, 9 to 30 percent slopes, eroded
LeF2	Linne silty clay loam, 30 to 50 percent slopes, eroded
LkF	Lodo rocky loam, 30 to 50 percent slopes
LoD2	Los Osos clay loam, 9 to 15 percent slopes, eroded
LoE2	Los Osos clay loam, 15 to 30 percent slopes, eroded
LoF	Los Osos clay loam, 30 to 50 percent slopes
MaE2	Malibu loam, 15 to 30 percent slopes, eroded
MaF	Malibu loam, 30 to 50 percent slopes
MeC	Milpitas-Positas fine sandy loams, 2 to 9 percent slopes
MhF	Millsholm loam, 15 to 50 percent slopes
MoC	Mocho loam, 2 to 9 percent slopes
NaD2	Nacimiento silty clay loam, 9 to 15 percent slopes, eroded
NaE2	Nacimiento silty clay loam, 15 to 30 percent slopes, eroded
NaF	Nacimiento silty clay loam, 30 to 50 percent slopes
ScF2	Santa Lucia shaly clay loam, 30 to 50 percent slopes, eroded
ScG	Santa Lucia shaly loam, 50 to 75 percent slopes
SeF	Santa Lucia shaly silty clay loam, 30 to 50 percent slopes
SoE2	Sespe clay loam, 15 to 30 percent slopes, eroded
SoF	Sespe clay loam, 30 to 50 percent slopes
SoG	Sespe clay loam, 50 to 75 percent slopes
SwC	Sorrento loam, 2 to 9 percent slopes
SzC	Sorrento clay loam, heavy variant, 2 to 9 percent slopes
SzD	Sorrento clay loam, heavy variant, 9 to 15 percent slopes
XA	Xerorthents, cut and fill areas

7.4 GEOMORPHOLOGY

Rincon Creek originates along the eastern end of the steep Santa Ynez Mountain Range and passes through foothills and coastal plains before reaching the Pacific Ocean at Rincon Point. Rincon Creek flows across several active faults and exhibits different characteristics through several geomorphic domains.

A geomorphic reconnaissance of the study reaches along Rincon and Casitas Creeks was undertaken in May of 2006. The geomorphic assessment examined the channel bed and banks and characterized the severity of bank erosion sites by categorizing erosional features and failures as "medium" or "large". Study reaches were also divided into "more stable" and "less stable" reaches. Interpretation of the reach reconnaissance findings is illustrated in Figure 7-4A. Slides along the banks that are more than 20 feet in height were characterized as "large". These slides are primarily located along large bends that cut into the valley walls. Slides that range in height from 5 feet to 20 feet or erosional features that are less than 20 feet high were characterized as "medium". "Small" erosional features are not considered significant in the watershed context and therefore are not shown on Figure 7-4A. Additional details regarding the geomorphic assessment are provided below.

7.4.1 Rincon Creek

The upper reaches of Rincon Creek were not evaluated, however, the expected conditions are described here. Rincon Creek, with a high gradient channel in the upper reaches (7 percent in the middle reaches and 20 percent in the upper reaches) flows through narrow canyons with steep slopes composed largely of sedimentary bedrock (Figure 7-5). The creek banks would be expected to be steep and often continuous with the canyon walls. The steep gradients along the upper reaches (20 percent) would generate high velocity creek flows, scouring and eroding sediments from the channel and the banks and transporting them downstream. Erosion and transport of sediments would be especially prevalent during heavy rainfall and corresponding high creek flows. The upper reaches of Rincon Creek are expected to have a cascade or step-pool channel morphology. Exposed bedrock and large boulders would be frequent, similar to the middle reaches.

As Rincon Creek flows though the middle reaches and across the foothills, gradient decreases (Figure 7-5), along with velocity and erosive capability. These areas between constitute the sediment transport link between the lowlands and the upper reaches. Sediment is stored along the valley bottom and in the channel on depositional areas such as point bars and riffles, as well as pools. The transport reaches along Rincon are slightly incised. Along the majority of Rincon Creek, the floodplain has been largely encroached upon by agriculture and urban uses. Under natural conditions the creek would deposit coarse sediment (cobble and gravel) in the bed while fine material (sand and finer) would be periodically deposited on the floodplain.

Through the downstream end of the foothill zone and the coastal plain, large boulders and exposed bedrock are usually infrequent or absent along the banks and channels of the creek. In this area, the creek banks and channels typically consist of cobbles, gravel, sand, and finer sediments. Channel gradients are approximately 2 percent in the lower reaches. There are many channel storage zones through this reach such as riffles and point bars. Rincon Creek has a high sediment load as evidenced by both coarse and fine sediment moving along the creek and by the existence of fine sediment everywhere throughout the study reach.

Rincon Creek channel exhibits various morphologies through the study reach. Upstream of the Casitas Creek confluence the channel has a step-pool morphology. Step-pool morphology is associated with steep gradients, small width to depth ratios, and significant confinement by valley walls. The channel along this reach has very steep, confined sections. The bed material is visibly larger than in the proximity and downstream of Casitas Creek confluence. Landslides along two large bends in this reach are characterized as "large".

Step-pool reaches typically provide more juvenile and adult habitat than any other stream type. However they often lack the range of habitat required for all stages of the life cycle of fish. If the creek system has pool-riffle reaches to provide spawning and rearing habitat downstream, this type of channel could be fully exploited and productive.

The Rincon Creek channel downstream of the confluence has a riffle-pool morphology with several plane-bed sections. Plane-bed channel form is a transitional condition between riffle-pool and step-pool, and provides excellent fish rearing and spawning habitat. Geomorphically, plane bed channels are associated with sediment transport rather than erosion or deposition. Riffle-pool channel form is valuable spawning and rearing habitat. Typically, it indicates a balance between sediment inputs and outputs. In Rincon Creek, because of the excess sediment delivery from hillslopes, the riffles at several reaches are embedded with fine sediment, reducing their adequacy as fish habitat.

Table 7-6 provides a list of waypoints and features that were identified. Steps and knickpoints are not listed. Figure 7-4B maps all waypoints collected.

Table 7-6: Rincon Creek Erosion and Deposition Areas

Waypoint(s)	Erosion/Deposition Feature
17	Large landslide on the left bank
30	Large landslide on the right bank
31 - 32	Depositional area
33	Landslide scars on the hill
34	Large landslide on the left bank
35	Medium erosion feature on the right bank
35 - 39	Slightly depositional area
39	Medium erosion feature on the right bank
40	Medium erosion feature on the right bank
42 - 43	Slightly depositional area
44	Medium erosion feature on the left bank
48	Large landslide on the right bank
49	Medium erosion feature on the right bank
50 - 52	Relatively nice reach
54	Medium erosion feature on the right bank
55 - 56	Medium erosion feature on the left bank
58	Small erosion feature
59	Small erosion feature on the right bank
60	Medium erosion feature on the left bank
62	Depositional area
64	Nice reach
66	Large slide on the left bank
68	Medium erosion feature on the left bank
69	Medium erosion feature on the left bank

Note: Right and left bank were determined when facing downstream.

7.4.2 Casitas Creek

The upstream reaches of the Casitas Creek were not surveyed because access was not granted. However, Highway 150 was driven and the channel was observed where visible. Casitas Creek appeared to be eroding its banks and slumping in the headland area. The Casitas Creek channel has very high channel gradients: approximately 23 percent in the upper reaches, grading down to 8.5 percent in the middle reaches, and to 4 percent in the lower reaches. These steep gradients are the result of steep topography in the watershed, as well as the bed incision as explained in the following paragraph. The channel mostly has a step-pool morphology in the upper reaches and plain bed morphology in the lower reaches.

Overall, erosion and sedimentation issues are more significant and prominent in the Casitas Creek watershed than in Rincon Creek watershed. The creek channel is undergoing extensive bank erosion throughout the study area to such an extent that all of Casitas Creek is characterized as erosion “hot spots” (Figure 7-4A). There has been significant downcutting of the bed in the recent past as evidenced by several hanging road crossings along the study reach. The channel has downcut as much 6 feet as noted in the middle reaches of the study area (Figure 7-4B, waypoints 84 and 87). The primary reason for the incision is likely to be the consequences of hydrologic and land use changes in the watershed. The agricultural development along this reach involved channel modification. The channel was straightened, relocated, and riparian vegetation was removed. Flows have become faster and more erosive (since the overall channel slope is steeper and friction due to vegetation is less). The channel has initially responded by downcutting. The banks along the channel have grown high and steep. Once the channel banks exceeded their critical stable height and angle they tend to slump. In addition, as the channel becomes deeper, flows that would previously have escaped from the channel and dissipated their erosive force as shallow flows on the floodplain were confined within the channel, further increasing bed erosion. This increases sedimentation downstream and tends to simplify channel bed features, reducing habitat features such as riffle-pool sequences.

During the geomorphic reconnaissance, the upstream end of the study reach along Casitas Creek was being channelized and modified (Figure 7-4B, waypoints 22 and 103). Table 7-7 provides a list of all waypoints and features that were identified. Steps and knickpoints are listed for Casitas Creek due to its recent severe incision history

Table 7-7: Casitas Creek Erosion and Deposition Areas

Waypoint	Erosion/Deposition Feature
22	Channel moved and straightened recently
63	Bed elevation difference between Casitas and Rincon
72	Banks erosion
73	Bank erosion on the left bank. Some deposition.
74	Depositional area
76	Bed elevation change
77	Medium erosion feature on the left bank
78	Medium erosion feature on the left bank
79	Medium erosion feature on the right bank
80	Large erosion feature on the left bank
81	Medium erosion features on both banks
82	Large erosion feature on the left bank
83	Confluence with the right bank tributary
84	Bed elevation change and failed road crossing
85	Large erosion feature on the left bank
86	Medium erosion feature on the left bank
87	Large erosion feature on the left bank
89	Large erosion feature on the left bank
90	Medium erosion feature on both banks.
91	Medium erosion feature on the left bank
92	Large erosion feature on the right bank
93	Medium erosion feature on the right bank
94	Large erosion feature on the left bank
95	Large erosion feature on the left bank
97	Medium erosion feature on the left bank
102	Medium erosion on the left bank.

Note: Right and left bank were determined when facing downstream

7.4.3 Summary of Current Conditions

Rincon Creek watershed is an erosional landscape set in mountainous terrain. The watershed is inherently unstable and erosion-prone due to rapid tectonic uplift, active faults, very weak rocks, and steep slopes. Landslides, debris flows, bank erosion and excess sedimentation are common in the watershed. Encroachment on to the floodplain, channel straightening, road building, and agricultural activities have exacerbated the naturally-unstable conditions in many parts of the watershed.

The most prominent geomorphic processes in the Rincon Creek watershed are debris flows, landslides on hill slopes and valley walls directly connected to the streams, and stream bank erosion. The key geomorphic issues in the Casitas Creek watershed are bed incision and subsequent bank erosion. Overall, Casitas Creek appears to contribute more sediment per unit area than Rincon Creek. The sediment load from Casitas Creek is finer in sediment size than that from Rincon Creek.

Rincon Creek has many stable reaches (Figures 7-4A and 7-4B, waypoints 50 to 52, 64) that can provide a reference condition and an indication of what a stable and well functioning channel represents in this system. These reaches are typically buffered with a riparian corridor and appear to be removed from the direct impacts of streamside land uses. The minimum width of the riparian corridor along these reaches is approximately 50 feet from the bank top. Where Rincon Creek channel has a buffer width of approximately 50 feet along a single bank or a riparian corridor width of approximately 120 feet, the system is relatively stable and would likely provide favorable conditions for fish if downstream barriers did not exist.

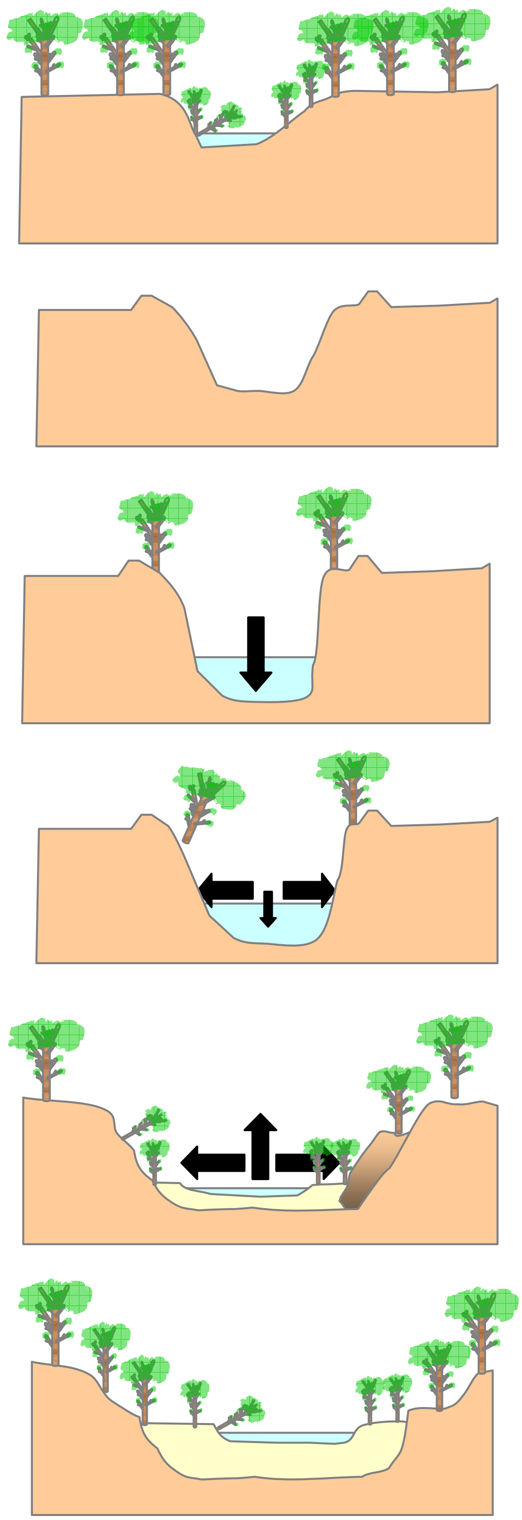
Conversely to conditions along Rincon Creek, Casitas Creek is severely degraded. It is undergoing significant changes that can be outlined with a conceptual channel evolution model. The channel evolution model shown in Graphic 7-3 summarizes the changes in channel bed and banks subsequent to disturbance. The model is based on the observed behavior of many disturbed systems in alluvial channels, and classifies channels into one of six stages.

The Casitas Creek channel can be classified as a Stage 4 channel. The channel bed is not expected to incise much further at a high rate due to siltstone outcrops in the bed. However, banks are currently responding to recent incision by collapsing under unstable angles and confined flows. If there are no additional disturbances or human intervention, Casitas Creek channel is likely to evolve from Stage 4 to Stage 6 over time, as bank erosion widens the stream corridor and terraces develop.

7.4.4 No-Action

The No-Action alternative maintains the status quo in the Rincon Creek watershed without any future action. Under the No-Action alternative, Rincon Creek will continue to erode its banks until it has incised to adjust to land use changes in the watershed. It will continue to incise then widen the channel until it has created a new floodplain and a low flow channel. Once it has created a new equilibrium, it will continue to carry its high sediment load through meandering reaches. It will continue to erode the outside bends until it avulses and changes course, potentially during high flows. It will deposit sediment on the inside bends forming point bars. These processes will be occurring along a limited-width corridor because Rincon Creek channel is flanked by valley walls and is relatively narrow. The erosion of outside bends would imply the gradual loss of riparian vegetation or loss of orchards where planted, until the channel shifts its course. A No-Action alternative for Rincon Creek assumes No-Action in Casitas Creek as well.

Casitas Creek has undergone incision and is currently undergoing widening through bank erosion. If not managed (that is if no future streamside human activity, bank stabilization, or channel maintenance occurs), the creek will eventually recover naturally. It will erode its former banks until it has widened to the point where it can create a new equilibrium channel and floodplain below the former floodplain terrace. At that point, the creek will be in a new equilibrium state and higher flows will again spill out of the new channel and dissipate erosive energy on the new floodplain. Without the excess energy, bank erosion rates will then slow down to “natural” rates. However, this recovery will take a long time. The widening would imply that the land and native or planted vegetation along the creek will be lost. Since the creek is not managed the recovery of the channel and subsequent loss of land would occur at unpredictable times and mostly unpredictable locations, posing a landuse and management problem.



Stage 1. 'Natural' channel. Channel is well connected to floodplain, with low banks and diverse habitat.

Stage 2. Constructed channel. Straightening, vegetation removal and levee construction channelize the stream, increasing its gradient and increasing flow velocity.

Stage 3. Incising channel. Channel downcuts in response to channelization, dissipating excess energy through bed erosion. Spawning gravel scoured.

Stage 4. Widening and incising channel. As incision increases bank height and angle, banks collapse and channel widens. Habitat dominated by continuous pools.

Stage 5. Widening and aggrading channel. Wider channel is unable to transport all collapsed bank material. Excess material forms terraces below former floodplain.

Stage 6. New dynamic equilibrium channel. Channel creates terraces and new floodplain. New channel meanders within the new floodplain, recreating a living river with diverse habitats.

Graphic 7-3: Channel Evolution

Source: The Schumm model, as modified by Simon and Hupp 1986

7.5 WATER QUALITY

7.5.1 Designated Beneficial Uses

The Rincon Creek watershed falls under the jurisdiction of the Water Quality Control Plan for the Central Coast Region, also known as the Basin Plan. This plan is the basis of water quality management for the Central Coast RWQCB. Beneficial uses listed for the Rincon Creek watershed are:

- Municipal and domestic supply.
- Agricultural supply
- Groundwater recharge
- Water contact recreation
- Non-contact water recreation
- Wildlife habitat
- Cold freshwater habitat
- Warm freshwater habitat
- Spawning, reproduction and development
- Rare, threatened, or endangered species
- Estuarine habitat
- Freshwater replenishment
- Commercial and sportfishing

The Basin Plan describes how water quality must be protected to maintain these beneficial uses and contains policies, programs, and actions necessary to achieve the water quality standards. Water quality objectives are also contained in the Basin Plan. Objectives are achieved through permits issued by the RWQCB and through implementation of the Basin Plan.

The Pacific Ocean at Rincon Point has been identified as an “impaired water” by the RWQCB for pathogens (presence determined through the occurrence of fecal coliform bacteria). A total maximum daily load (TMDL) must be developed for each impaired waterbody. The TMDL is a measure of the quantity of a pollutant that can be uptaken by a waterbody without violating water quality standards.

7.5.2 Summary of Water Quality Conditions

As described in Section 5, numerous past and current water quality sampling activities occur within the watershed. In general, the following has been observed:

- Elevated nitrogen and phosphorus levels.

- Ammonia occurs at concentrations shown to be toxic to aquatic life.
- Elevated bacteria levels, particularly during the first rainfall of the year.
- Elevated sediments within Casitas Creek and within various locations of Rincon Creek.
- Impaired for boron (toxicity).

7.6 BIOLOGICAL RESOURCES

7.6.1 Steelhead Habitat

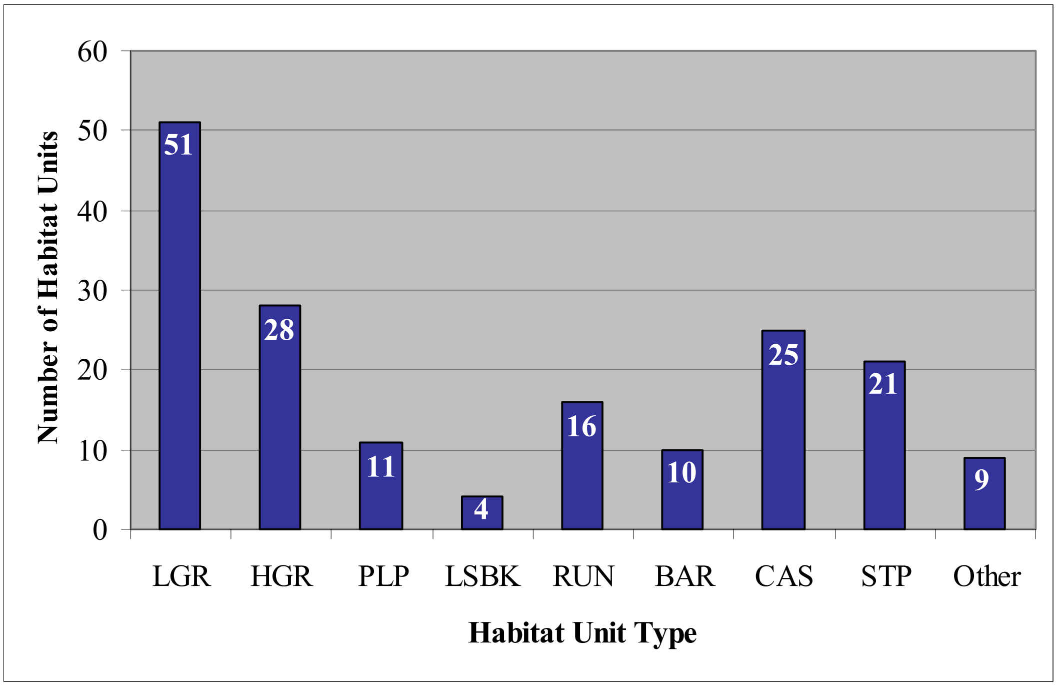
As described in Section 6.0, data were collected during May 2006 to assess steelhead habitat within Rincon Creek and the Casitas Creek tributary. Reaches were assigned an overall rating of excellent, very good, good, fair, or poor in terms of pools/habitat type, substrate, instream shelter, and canopy closure for adult steelhead. Each of these components of steelhead habitat is described in more detail below. It should be noted that the data collected in May 2006 represents a snapshot of the field conditions at that time.

Pools/Habitat Type

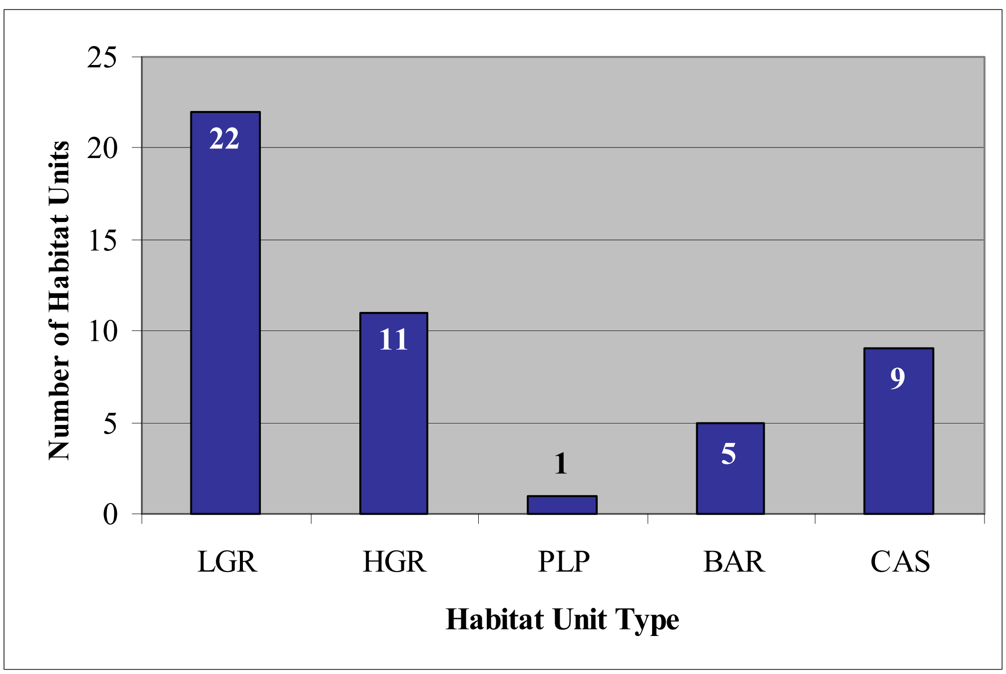
As shown in Figure 7-6, from the ocean upstream to the Highway 101 culvert contains good steelhead habitat. This area contains a small lagoon and low-gradient riffle habitat. From the Highway 101 culvert upstream to the confluence with Casitas Creek, the steelhead habitat is rated as fair. This stretch of the creek is dominated by riffle habitat. Although this area of the stream has sufficient water depth to support adult steelhead, the lack of pool habitat reduces the habitat quality rating to fair.

Within Rincon Creek upstream of the confluence, the steelhead habitat is good in some areas, but fair in others. This area of the creek has a higher frequency of pool habitat that is intermixed with riffle habitat, which improves the habitat value for steelhead in this area. Graphic 7-4 provides a breakdown of the habitat unit types recorded for Rincon Creek.

Within Casitas Creek, steelhead habitat is rated as poor throughout the area surveyed (Graphic 7-5 and Figure 7-6). There was only one pool observed within the entire length of Casitas Creek that was surveyed. This pool is created by a man-made road crossing. The lack of pool habitat combined with shallow maximum water depths indicates that Casitas Creek contains poor habitat for adult steelhead.



Graphic 7-4: Rincon Creek Habitat Unit Types
LGR=Low Gradient Riffle, HGR=High Gradient Riffle, PLP=Plunge Pool, LSBK=Lateral Scour Pool – Bedrock Formed, RUN=Run, BAR=Barrier, CAS=Cascade, STP=Step Pool, Other=see Section 6.0.



Graphic 7-5: Casitas Creek Habitat Unit Types
LGR=Low Gradient Riffle, HGR=High Gradient Riffle, PLP=Plunge Pool, BAR=Barrier, CAS=Cascade.

Substrate

As shown in Figure 7-7, within Rincon Creek from the Highway 101 culvert upstream to the confluence with Casitas Creek the substrate for steelhead ranges between good, very good, and excellent. Substrate in this area varies, the dominant substrates recorded were silt/clay, cobble, and gravel. This area of the stream had a low percent embeddedness, and spawning gravel occurred in the majority of the habitat units. The average percent of silt/clay ranged from 4 to 31 percent. These results indicate that the substrate in this length of the stream varies.

As shown in Figure 7-7, the substrate within the downstream portion of Casitas Creek was rated overall as excellent. This area has a low average percentage of silt/clay, is dominated by boulder habitat, has a low average embeddedness, and spawning gravel was present in all of the habitat units that were sampled. In the upper portion of Casitas Creek that was surveyed, the substrate was rated as very good overall. This area has a higher percentage of average silt/clay, has mixed substrates (silt/clay, sand, cobble, gravel), has a low average embeddedness, and spawning gravel was present in all of the habitat units that were sampled.

Instream Shelter

As shown in Figure 7-8, within Rincon Creek from the Highway 101 culvert upstream to the confluence with Casitas Creek is rated as poor, although there is a small reach just upstream of the 101 culvert that is rated as fair.

Within Rincon Creek upstream of the confluence with Casitas Creek, there are small lengths with fair instream shelter and other reaches with poor instream shelter. As shown in Figure 7-8, instream shelter within Casitas Creek is rated as poor throughout the area surveyed.

Canopy Closure

As shown in Figure 7-9, the canopy closure rating within Rincon Creek from the 101 culvert up to the confluence with Casitas Creek varied between fair, good, and very good. Within Rincon Creek upstream from the confluence of Casitas Creek to the rock quarry the canopy closure ratings improved slightly, with some reaches being rated as excellent and the majority of the remaining areas being rated as very good.

As shown in Figure 7-9, canopy closure ratings for Casitas Creek were fair, very good, and excellent.

Overall Steelhead Habitat

The four habitat components of pools/habitat type, substrate, instream shelter, and canopy closure were combined to determine an overall steelhead habitat rating. These results are mapped in Figure 7-10.

Within Rincon Creek from the Highway 101 culvert upstream to the confluence with Casitas Creek has reaches rated as fair and good for overall steelhead habitat. Upstream of the confluence, Rincon Creek is rated as good and very good for overall steelhead habitat.

Casitas Creek has a small stretch of poor steelhead habitat and reaches of fair and good overall steelhead habitat.

Habitat Quantity and Quality

Table 7-8 lists the amount of steelhead overall habitat within Rincon Creek downstream and upstream of the confluence with Casitas Creek and within Casitas Creek.

Table 7-8: Steelhead Habitat

Habitat Quality Rating	Rincon Below Confluence (meters)	Rincon Above Confluence (meters)	Casitas Creek (meters)
Excellent	-	-	-
Very Good	-	604	-
Good	2,778	1,987	1,368
Fair	1,286	-	451
Poor	-	-	234
Barriers*	291	56	110

Note: *Barriers are not a habitat quality rating, but are shown to indicate the amount of habitat that is occupied by barriers.

The values listed in Table 7-8 indicate that Rincon Creek contains 9 percent very good, 72 percent good, and 19 percent fair steelhead habitat. It should be noted that this analysis has not taken into consideration the results of the turbidity samples taken throughout the watershed. This analysis also weights the four habitat factors equally (pools/habitat type, substrate, instream shelter, canopy closure).

Habitat Upstream from the Rock Quarry

In December 2006, a brief field survey was undertaken above the rock quarry in order to perform a general assessment of habitat in the area. Field crew members began at the rock quarry and continued up the mainstem of Rincon Creek and covered a portion of Catherina Creek, as shown in Figure 1-1. Within Rincon Creek above the rock quarry the riparian habitat is in very good condition. The habitat in this area is step-pool, combined with riffles, boulder cascades, and bedrock and boulder chutes. This area was also noted to have oil and tar deposits, as shown in Graphic 7-6. Within Catherina Creek, just upstream of the confluence with Rincon, the creek flows over a complex of boulders (see Graphic 7-7). Although there are anecdotal reports of trout occurring in Catherina Creek, given the presence of the barrier immediately upstream, it is unlikely that steelhead would be able to migrate upstream within Catherina Creek.

Graphic 7-6: Oil Deposits in the Upper Watershed

Graphic 7-7: Catherina Creek

7.6.1.1 Impacts of Sedimentation on Steelhead

Increased sedimentation can alter the hydrology of a watershed, which in turn affects habitat for steelhead and other aquatic resources. Pools will become shallower and over time a reduction in the pool-riffle habitat sequence will occur. Within Rincon Creek, the pools/habitat type ratings for the lower watershed were lower for those in the upper watershed. The high sedimentation occurring within the lower watershed has likely led to a reduction in the number of pools within the lower reaches, thus decreasing the pool habitat available for steelhead.

Increased sedimentation can also affect steelhead by causing physiological damage, reduced reproduction, and a reduction in aquatic insects (prey). As sediments settle out of the stream they can cover spawning sites, smother eggs, prevent the emergence of young, and decrease the instream shelter available.

7.6.2 Steelhead Upstream Migration Barriers

Information previously reported on upstream steelhead migration barriers (Stoecker *et al.* 2002) was updated during the May 2006 survey. Rincon Creek currently contains 11 barriers to steelhead migration, only one of which is natural. The final upstream barrier within Rincon Creek is the rock quarry. Historically a natural waterfall over 70 feet high occurred in this area; this location was likely the natural upstream limit of anadromy prior to the rock quarry operation. Casitas Creek contains 5 barriers, of which one is natural. The barriers within each creek are described in Tables 7-9 and 7-10 and mapped within Figure 7-11.

Of particular importance for steelhead is the Highway 101 culvert (Graphic 7-8). A detailed analysis of the culvert was provided by Stoecker *et al.* 2002 and is summarized here. The outlet apron is at streambed level or slightly submerged, depending on the stream flow and lagoon influence from downstream. The concrete arch culvert has a shallow U-shaped bottom and a mild slope that occurs for approximately 250 meters to the base of a steep inlet apron (upstream end of the culvert). Within the culvert are three small (0.2-0.3 meter) concrete steps. The inlet apron is 12.5 meters long and contains a vertical height of 2 meters from the downstream culvert bottom to the upstream apron lip. The slope of the inlet apron is greater than 15 percent.

During migration flows, steelhead can easily enter into the outlet of the culvert. The mild slope of the culvert and the three small drops would allow moderately difficult upstream passage of adult steelhead for the 250 meter length of the culvert up to the inlet apron. However, the steep slope of the inlet apron, the length, and the smooth concrete features generate excessive water velocities during all migration flows. Shallow conditions exist during lower stream flows, further preventing upstream steelhead passage. As a result, the Highway 101 culvert is impassable by steelhead under all flow conditions. Local landowners have also observed fish at the inlet apron that have not been able to migrate upstream.

Table 7-9: Rincon Creek Steelhead Upstream Migration Barriers

Barrier Number	Type	Owner	Description	*Severity	**Distance to Next Upstream Barrier (m)
R_1	101 Culvert	Caltrans	Concrete arch culvert	Impassable	4,050
R_2	Rock/concrete wall	Private	Stone dam creating swimming pool.	Moderate	191
R_3	Concrete Road Crossing	Private	Concrete and steel road crossing.	Extremely High	69
R_4	Concrete Road Crossing	Private	Concrete and steel road crossing.	Moderate	666
R_5	Concrete Road Crossing	Private	Concrete and steel road crossing.	Extremely High	245
R_6	Concrete Road Crossing	Private	Concrete and steel road crossing.	Extremely High	137
R_7	Dirt Road Crossing	Private	Dirt road crossing.	Extremely High	287
R_8	Concrete Road Crossing	Private	Concrete and steel road crossing.	Extremely High	146
R_9	Concrete Road Crossing	Private	Concrete and steel road crossing.	Low	415
R_10	Natural Bedrock Cascade	Private	Natural cascasde.	Light	311
R_11	Rock Quarry	Forest Service	Large boulder cascade.	Impassable	-

*Severity ratings are from Stoecker *et al.* 2002. Listed from the most impassable to least impassable: Impassable, Extremely High, Light, Moderate, Low, Undetermined.
**Distance to next upstream barrier indicates the amount of habitat that would be made available if the barrier were removed. For example, remediation of the Highway 101 culvert would provide steelhead access to 4,050 meters of upstream habitat within Rincon Creek, at which point R_2 occurs.

Graphic 7-8: Upstream Apron of the Highway 101 Culvert

Table 7-10: Casitas Creek Steelhead Upstream Migration Barriers

Barrier Number	Type	Owner	Description	*Severity	Distance to Next Upstream Barrier (m)
C_1	Concrete Road Crossing	Private	Concrete crossing with large concrete apron.	Extremely High	180
C_2	Concrete Road Crossing	Private	Concrete crossing with concrete apron, large failed culvert, no pool habitat below.	Extremely High	65
C_3	Natural Log Jam	Natural	Natural log jam.	Low	490
C_4	Pipe culvert	Private	Two culverts, steep incline slope, large landslide upstream.	Impassable	394
C_5	Dirt Road Crossing	Private	Horizontal pipes.	Moderate	-

*The severity rating system developed by Stoecker *et al.* 2002 was used to evaluate Casitas barriers during the May 2006 survey. Listed from the most impassable to least impassable: Impassable, Extremely High, Light, Moderate, Low, Undetermined.
**Distance to next upstream barrier indicates the amount of habitat that would be made available if the barrier were removed.

7.6.3 Steelhead Limiting Factors Analysis

Data collected during May 2006 were reviewed to analyze the factors that are most likely limiting the steelhead population under the current conditions. Evidence indicates that steelhead historically used the Rincon Creek watershed. Under the current conditions, the Highway 101 culvert is blocking access to the watershed. Therefore, the Highway 101 culvert is the main factor that is limiting the current steelhead population. There are also additional steelhead migration barriers within Rincon and Casitas Creeks that would further limit the mobility of steelhead within the system once the Highway 101 culvert is remediated. These barriers are potential upstream steelhead migration barriers and may also act as downstream barriers to juvenile steelhead migrating to the ocean.

High sediment input from Casitas Creek into the mainstem of Rincon Creek is degrading all habitat that is downstream of the confluence of the two creeks. This sedimentation is also a limiting factor for steelhead, although until the Highway 101 culvert is modified to allow for fish passage, there will likely be no or few steelhead that would be impacted by the increased sedimentation. Sedimentation can cause a range of direct effects to steelhead, including physiological damage, reduced reproduction, and reduced juvenile growth rates. Increased sedimentation also can cause a reduction in the pool-to-riffle sequence, as seen in Rincon by the fewer number of pools within the lower reaches of the watershed. However, within Rincon Creek upstream from above the confluence with Casitas Creek, the creek had very low turbidity values, indicating that increased sedimentation is not occurring in the upper watershed. Therefore, the increased sedimentation is a limiting factor only for the area of Rincon Creek that is downstream from the confluence with Casitas Creek and also for Casitas Creek.

Although data taken in May 2006 shows that temperatures within Rincon and Casitas Creeks occur within ranges found in other southern California streams known to support steelhead (Section 7.6.6), additional data is needed to determine if summer temperatures could place stress on steelhead, particularly the summer growth rates of juvenile steelhead. Elevated temperatures are likely to occur in areas that are lacking riparian habitat.

Additional factors that may limit steelhead populations within the watershed that were not evaluated here are:

- Summer flow (i.e., which areas of Rincon and Casitas Creeks may run dry during the summer).
- Gravel permeability (the flow of cool, clean water through spawning gravel to provide dissolved oxygen and to eliminate metabolic wastes).
- Additional effects of sediment deposition, including increased frequency or intensity of redd scour.
- Juvenile steelhead growth rates.
- Prey availability.

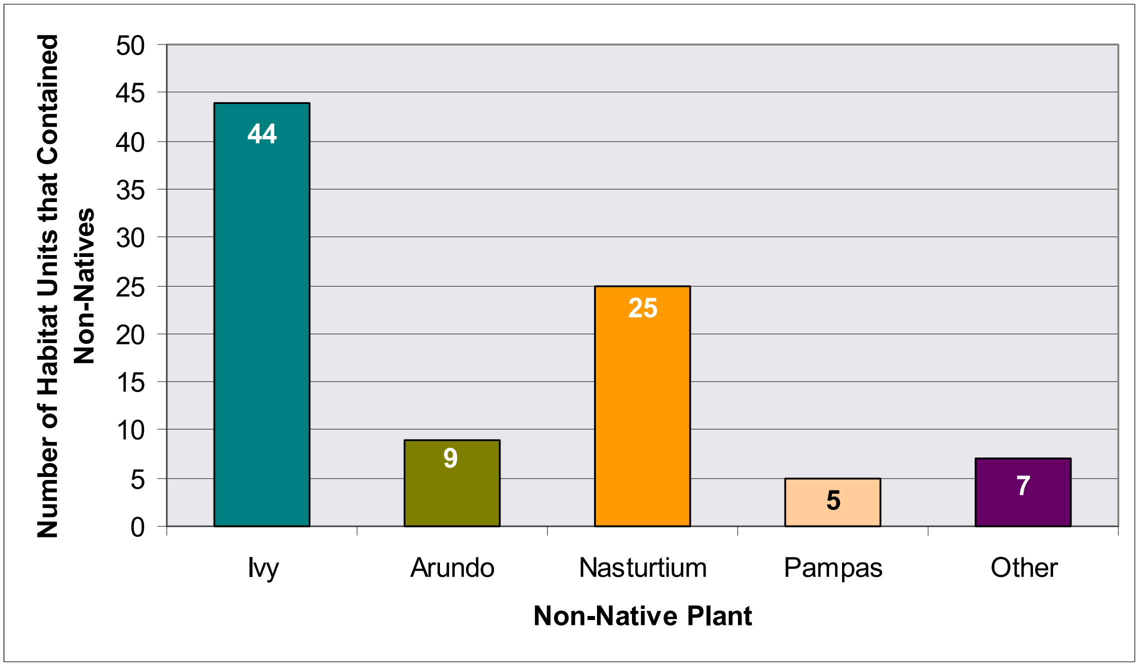
Under the current condition, the Highway 101 culvert is the primary factor that is limiting the current population of steelhead within the Rincon Creek watershed.

7.6.4 Non-native, Invasive Plant Species

During the May 2006 data collection, locations of large patches of non-native, invasive plant species were noted. Figures 7-12A and 7-12B depict these locations. Ivy (Cape and English) was present throughout the watershed. Below the confluence with Casitas Creek, ivy and nasturtium were frequently noted within Rincon Creek. Giant reed (*Arundo donax*) also occurs within this area. Within Rincon Creek above the confluence with Casitas Creek, giant reed did not occur. In many cases, large areas of the bank of the creek were covered in a mixture of ivy and nasturtium, as shown in Graphic 7-9.

Graphic 7-9: Creekbank Overrun with Nasturtium and Ivy

Graphic 7-10 depicts the number of habitat units that contained non-native, invasive plant species within Rincon Creek. Within Casitas Creek, large areas of nasturtium and ivy were also noted.



Graphic 7-10: Non-native, Invasive Plant Species within Rincon Creek

Other: Eucalyptus trees, castor bean, iceplant. Rincon Creek contained a total of 174 habitat units. In some cases, a habitat unit contained more than one non-native species (i.e., ivy and nasturtium occurred frequently within the same habitat unit).

During the field survey conducted in May 2006, a comprehensive list of non-native plant species observed was developed and is provided in Table 7-11. This list includes those species that at times dominated the creek banks (as shown in Figures 7-12A and 7-12B) and also includes additional non-native species that were present in smaller numbers in the watershed. Some species were present in lower than expected numbers. For example, giant reed was found at only nine locations, all of which occurred in the lower watershed. Periwinkle was also present in low numbers in the watershed.

Table 7-11: Non-native Plant Species Observed in Rincon and Casitas Creeks

Common Name	Scientific Name	Notes
Bermuda grass	*Cynodon dactylon*	Present.
Bristly ox-tongue	*Picris echioides*	Present.
Cape Ivy	*Delairea odorata*	Large patches present.
Castor bean	*Ricinus communis*	Present.
English Ivy	*Hedera helix*	Large patches present.
Eucalyptus Trees	*Eucalyptus* sp.	Present
Giant reed	*Arundo donax*	Nine locations in lower watershed only.
Harding grass	*Phalaris aquatica*	Present.
Ice plant	*Carpobrotus chilensis*	Present.
Italian thistle	*Carduus pycnocephalus*	Present.
Ivy geranium	*Pelargonium peltatum*	Present.
Mexican fan palm	*Washingtonia robusta*	Present.
Nasturtium	*Tropaeolum majus*	Large patches present.
Nightshade	*Solanum americanum*	Present.
Pampas grass	*Cortaderia* sp.	Present.
Periwinkle	*Vinca major*	Present.
Peruvian pepper tree	*Schinus molle*	Present.
Poison hemlock	*Conium maculatum*	Present.
Rabbit's foot grass	*Polypogon monspeliensis.*	Present.
Summer mustard	*Hirschfeldia incana*	Present.
Sweet Fennel	*Foeniculum vulgare*	Present.
Tree-of-Heaven	*Ailanthus altissima*	Present.
Tree tobacco	*Nicotiana glauca*	Present.
Wild radish	*Raphanus sativus*	Present.

Notes: The survey conducted in May 2006 was not botanical and this list of non-native species is not intended to include all non-native plant species present in the watershed. Some ornamental species and agricultural species (avocado trees, etc.) are not included.

7.6.4.1 Impacts of Non-native, Invasive Plant Species

Non-native, invasive plant species can cause a range of impacts. Additional information regarding the dominant non-native, invasive plant species within the watershed are described below.

Giant Reed

Giant reed (*Arundo donax*) is a fast-growing and spreading plant that resembles bamboo and occurs in many streams in California and throughout the U.S. It is native to the Mediterranean region and was introduced to California in the 1820s. This species occurs in moist areas, typically along streams. It spreads by breaking off clumps, which travel downstream and establish new colonies. Giant reed has shallow roots, which provide poor erosion control. It is also adapted to fire, as burned stalks can travel downstream and resprout.

The species outcompetes native vegetation, resulting in thick stands that are devoid of native species. When this occurs, the habitat for plant and wildlife species is reduced and a reduction in food for wildlife also occurs.

Large giant reed stands also reduce the riparian canopy closure, which increases the amount of sunlight within streams. This can lead to increased water tempeatures, which decreases dissolved oxygen content of the waters. Increased water temperatures and decreased dissolved oxygen levels are detrimental to steelhead. Studies have also shown that there is a reduced diversity and abundance of riparian birds in areas heavily infested by giant reed (Dudley 2006). Giant reed can also increase erosion and sedimentation and create points of debris accumulation in streams.

Cape Ivy

Cape ivy (*Delairea odorata* previously known as *Senecio mikanioides*) is native to the cape of South Africa. This species has shallow roots and is drought-tolerant. It typically is found invading the ground and shrub layers and on disturbed moist sites. It can spread vigorously by sending runners in all directions and reproduces by rooting from the stem or any part of the plant that touches the ground. Cape ivy climbs over existing vegetation and smothers native plants. In areas with thick patches of Cape ivy, increases in erosion and flooding can occur. It also contains chemicals that are harmful to animals, including fish.

Nasturtium

Nasturtium (*Tropaeolum majus*) is a non-native species that has invaded many areas along the coast of California. It is also a commonly used garden species. This vine spreads along the ground and shrub layer and often covers native species. It spreads by seeds, vine-like runners, and cuttings. This species has shallow roots, and can be removed through hand-removal or herbicide use. Like ivy, any pieces of the plant that are not removed will be need to be treated, as they can resprout.

7.6.5 Riparian Corridor

Rincon and Casitas Creeks contain areas that are lacking an intact riparian corridor. There are multiple reasons for the lack of riparian habitat, including:

- Avocado trees are present on the creekbanks.
- Rip-rap is present, without vegetation or with avocado trees present along the creekbanks.
- Pipe and wire revetment is present along the banks, sometimes with vegetation present, other times without vegetation.
- Large landslide (occurred recently).

Areas lacking an intact riparian corridor are mapped within Figures 7-13A and 7-13B. In general, Casitas Creek was found to have much less of a riparian corridor than Rincon Creek.

7.6.6 Physical Parameters

As described in Section 6.0, the pH, DO, and temperature were measured during the fieldwork conducted in May 2006. Locations where these measurements were taken are shown in Figure 6-1. These measures were taken only one time at each sampling location and therefore only represent the conditions at the time of sampling. In addition, these measurements vary depending on the time of day. For example, temperature values increased throughout the day.

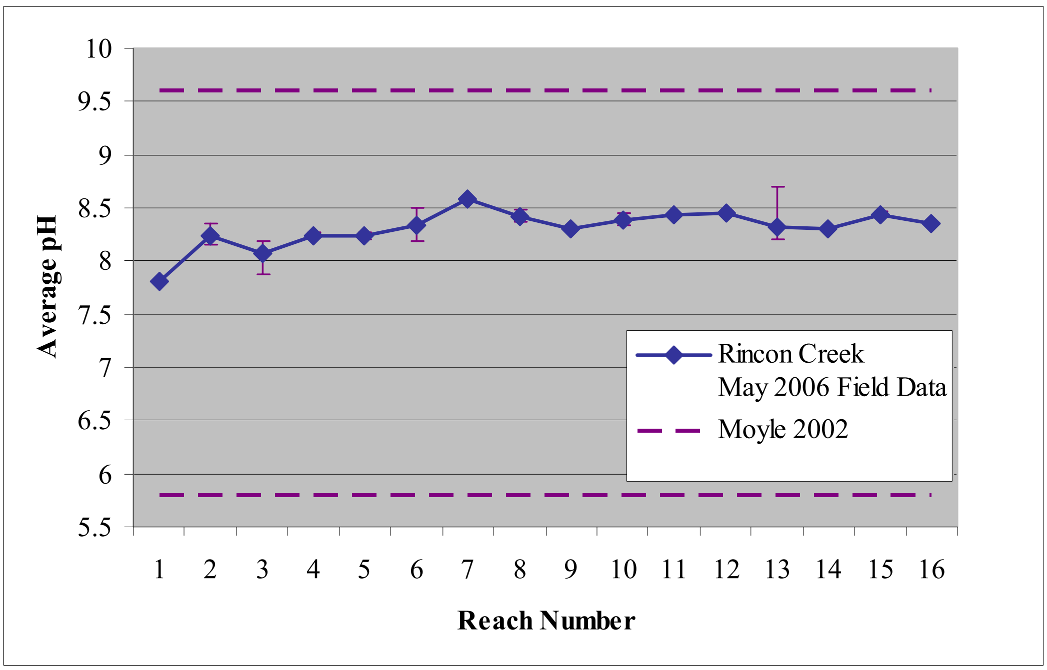
In order to evaluate if the pH, DO, and temperature data were within acceptable ranges for steelhead, data for Malibu Creek and Topanga Creek were reviewed. These creeks were selected since they are located in southern California and since both creeks currently support steelhead. As shown in Table 7-12 and

Graphics 7-11, 7-12, and 7-13, pH, DO, and Temperature measurements for Rincon and Casitas Creeks were within the data ranges reported for Malibu Creek and Topanga Creek.

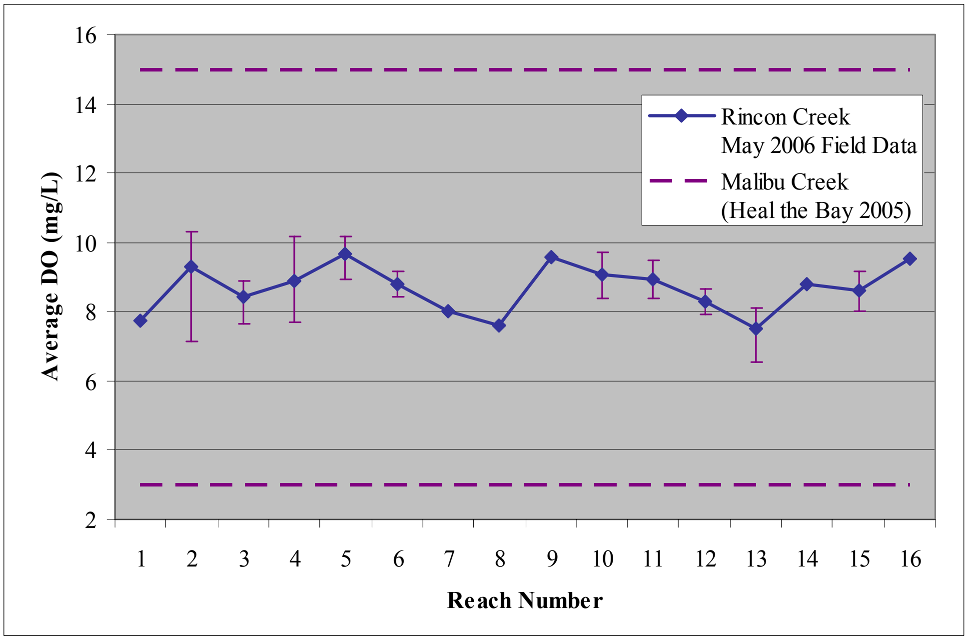
Table 7-12: Physical Parameters Comparison

	pH	DO (mg/L)	Temperature (°C)
Rincon Creek	7.8 – 8.6	6.0 – 10.3	14.5 – 21.9
Casitas Creek	7.6 – 8.2	6.4 – 9.3	14.9 – 20.2
Moyle 2002	5.8 – 9.6	-	-
Malibu Creek (Heal the Bay 2005)	6.7 – 9.3	3 – 15	<27
Topanga Creek (Dagit 2003, 2004)	7 – 8.5	6 – 15	14.9 – 27.8

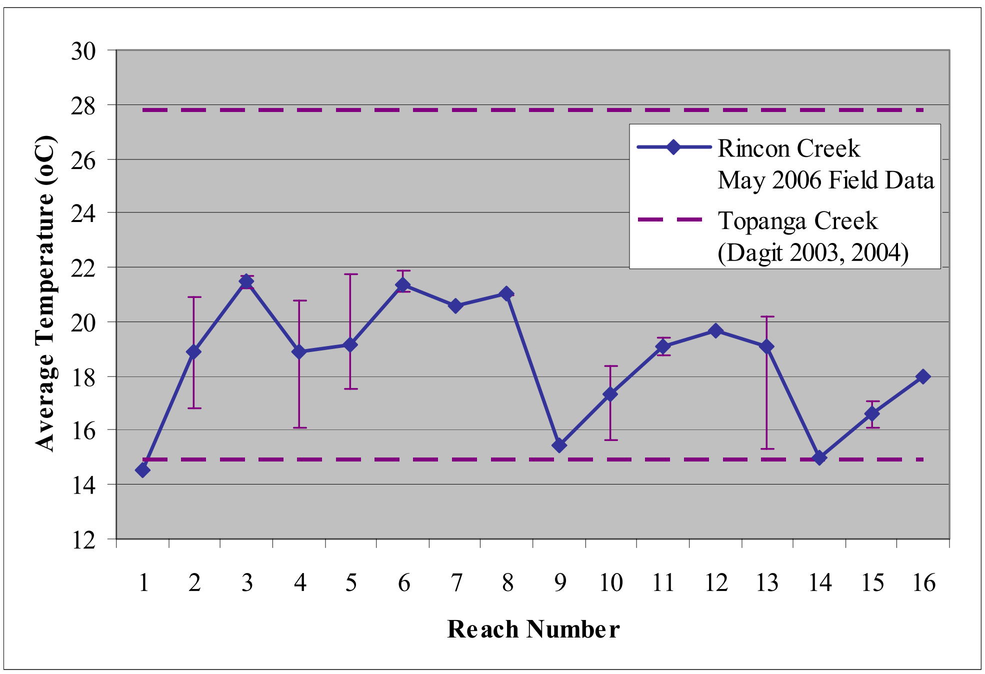
Note: The range in values measured during May 2006 are shown for Rincon and Casitas.



Graphic 7-11: Average pH of Rincon Creek



Graphic 7-12: Average DO of Rincon Creek Compared to Malibu Creek



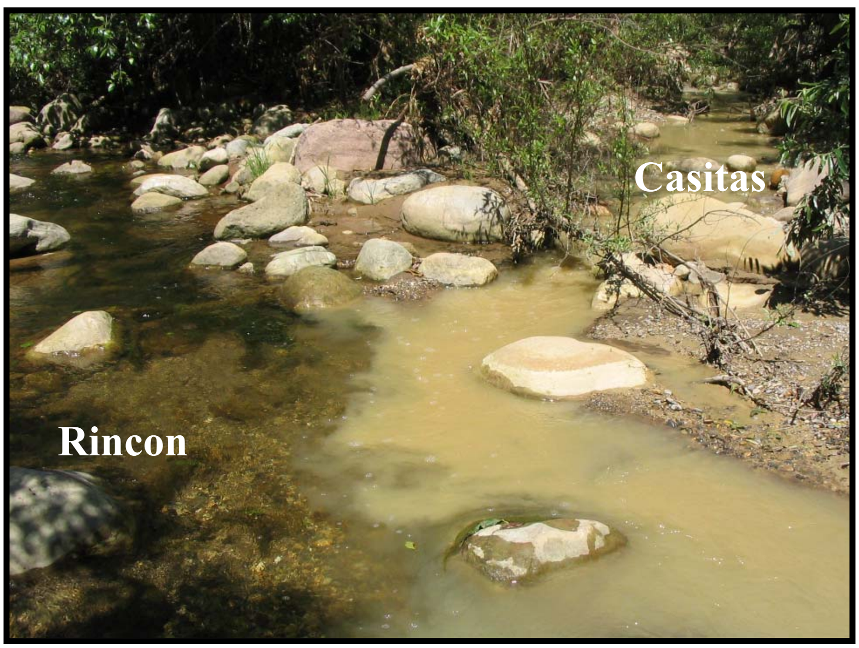
Graphic 7-13: Average Temperature of Rincon Creek Compared to Topanga Creek

Turbidity values were also measured in May 2006. A very distinct pattern of turbidity values is evident for the watershed, as shown in Figure 7-14. Within Rincon Creek from the Highway 101 culvert upstream to the confluence with Casitas Creek, the average turbidity ranged between 100 and 200 NTUs. Within Rincon Creek upstream of the confluence with Casitas Creek, the average turbidity ranged between 0 and 10 NTUs. Average turbidity values within Casitas Creek ranged between 201 and 350 NTUs. This data indicates that Casitas Creek has the most turbid water and is increasing the turbidity of downstream waters.

On Monday, May 22, 2006 the field survey of Rincon Creek began. Over the weekend, an unexpected rainstorm had occurred, and on Monday slight rain was still occurring. This allowed the field crew the opportunity to visit the confluence of Rincon and Casitas Creeks. Graphic 7-14 shows the state of the Creeks on Monday, May 22, 2006.

Graphic 7-14: Rincon and Casitas Creeks on Monday, May 22, 2006
Note: Downstream view

Two days later, the field crew returned to the confluence. At this time, the water within Rincon Creek was no longer turbid, while Casitas Creek waters remained cloudy, as shown in Graphic 7-15.



Graphic 7-15: Rincon and Casitas Creeks on Wednesday, May 24, 2006
Note: Upstream view

The potential effects of turbidity were described in Section 7.6.1.1.

7.7 ANTHROPOGENIC CHARACTERISTICS

7.7.1 Population and Development Trends

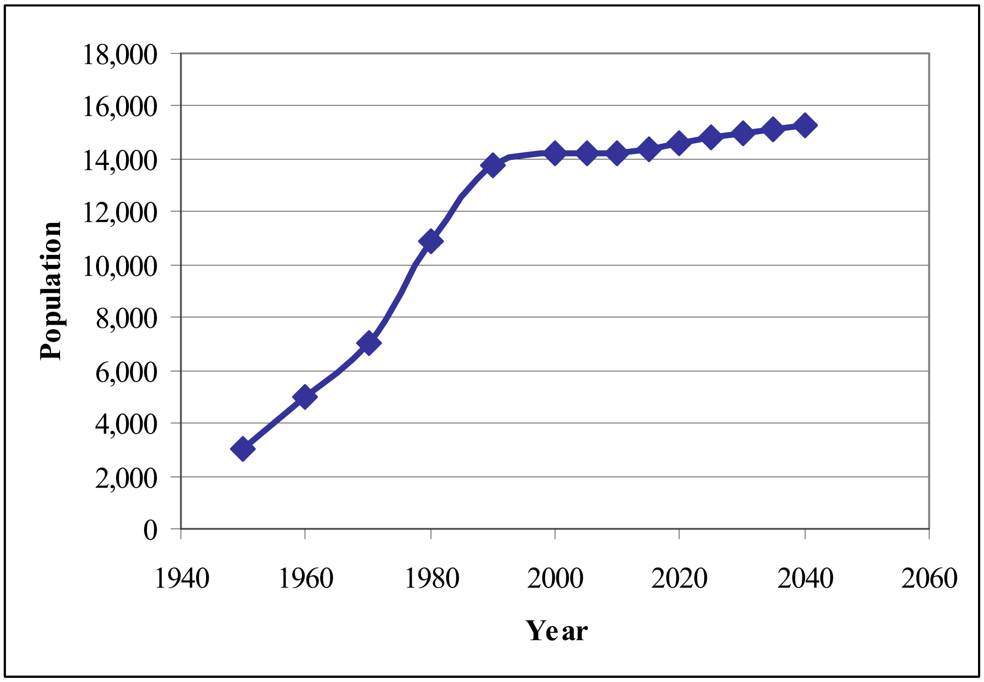
Given that the watershed lies within unincorporated areas of Ventura and Santa Barbara Counties, population data specifically for the watershed is not available. Population data for the City of Carpinteria is used to provide information about growth trends in the closest city to the watershed. This analysis is provided below.

Historical, current, and projected populations for the City of Carpinteria and shown below in Table 7-13 and Graphic 7-16. Historical population trends for the City of Carpinteria show dramatic increases from 1950 to 1990 with in an increase of 360 percent over 40 years. Growth rates decreased dramatically from 1992 to 2001. During this time the population increased by about 500, approximately 0.7 percent average annual growth rate (City of Carpinteria 2007). Current populations show relatively no increase with the population steady at 14,200 from 2000 to 2010. Projected populations show either zero or minimal increases in populations. From 2015 to 2040 the population is projected to increase by 900, a 6.25 percent increase.

Table 7-13: City of Carpinteria Population

Year	City of Carpinteria
1950*	3,000
1960*	5,000
1970*	7,000
1980**	10,900
1990**	13,800
2000**	14,200
2005	14,200
2010	14,200
2015	14,400
2020	14,600
2025	14,800
2030	15,000
2035	15,100
2040	15,300

Sources:
Santa Barbara County Association of Governments 2006
*Santa Barbara County Association of Governments 2002
**City of Carpinteria 2007



Graphic 7-16: City of Carpinteria Population Trends

Agricultural land within Santa Barbara and Ventura Counties are increasingly under urbanization pressure. Both Counties have planning policies that aim to protect farmland, however, there remain significant development pressures on agricultural lands that lie outside the current urban boundaries. In a study completed in 2003, urbanization trends from 1986 to 2000 within Ventura County were examined (Fulton *et al.* 2003). This study found that the vast majority of farmland is located outside the urban growth boundaries and that the growth boundaries did not protect all farmland and environmentally sensitive land. A major trend identified was that urbanization continues to increase and farmland continues to decrease. Between 1986 and 2000, it was found that urbanized land increased by 20.4 percent, while farmland decreased by 13.9 percent.

This study illustrates the development pressures faced by much of California, including the Rincon Creek watershed. Although the population forecast for the City of Carpinteria (Graphic 7-16) shows relatively low population growth, the 2003 study indicated that farmland outside the urban boundaries is being converted to urbanized uses regardless of population trends.

The high percentage of the watershed that is currently used for agriculture or open space benefits local residents and ecosystems. The undeveloped land provides habitat for plants and wildlife, and land that is used for recreational activities and aesthetic enjoyment, among other benefits. If agricultural and open space lands are lost, there will be an accompanying increase in impervious surfaces which will increase the runoff and sedimentation within the watershed.

An examination of the planning records of the Santa Barbara County permit history by parcel database and the Ventura County permitting records was performed in order to estimate the amount of past and planned future development within the watershed. There are currently no planning records for large future developments in the watershed. The planning records indicate a number of small projects, like modifications to single family homes, infrastructure projects (fiber optic cable installation), and associated agricultural facilities (barns, etc.).

7.7.2 Recreational Users

Rincon Point is world renown for possibly some of the best surfing on America's mainland. Almost every major surf competitor has surfed the point. Visitors and residents of Rincon Point enjoy the wonderful ocean views, have picnics, take photographs, bird watch, swim or stroll the beach.

7.7.3 Infrastructure at Rincon Point

Rincon Point is the site of 72 homes and two restroom facilities that are part of Rincon Beach County Park. Sewage treatment on the point is provided by septic systems. In 2000, the Carpinteria Sanitary District began studies to evaluate the feasibility of connecting homes in the Rincon Point neighborhood to the Carpinteria Sanitary District's treatment facilities. In the future, the homes and restroom facilities that currently rely on septic systems at Rincon Point may or may not convert to a sewer system.

The Rincon Beach County Park also contains parking lots that may contribute to downstream water quality issues. Future improvements to these parking lots may be implemented to reduce the contribution of the parking lots to downstream water quality issues.

7.8 CURRENT WATERSHED MANAGEMENT ACTIVITIES

7.8.1 Agricultural Management

The southern San Luis Obispo and Santa Barbara Counties Agricultural Watershed Coalition is made up of the following members:

- Central Coast Wine Grower's Association
- Grower Shipper Vegetable Assocation of San Luis Obispo & Santa Barbara Counties
- Santa Barbara County Farm Bureau
- Santa Barbara County Flower & Nursery Growers Association
- Santa Barbara County Cattleman's Association

In July 2004, the Central Coast Regional Water Quality Control Board adopted the *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands* (Ag Waiver). Every grower that irrigates and sells crop commercially is required to be enrolled in the Ag Waiver program. The Ag Waiver regulates discharges from irrigated land and allows the RWQCB to waive Waste Discharge Requirements. The intent behind the Ag Waiver is to ensure that discharges do not cause or contribute to water quality impairment and watershed monitoring is required to document whether water quality improves. Under the Ag Waiver, growers are required to attend continuing education classes, complete a Farm Water Quality Plan, implement Management Practices as outlined in the Farm Plan, and participate in an individual or cooperative monitoring program. The Farm Plan should identify practices to address pesticide management, nutrient management, irrigation management, and erosion control.

7.8.2 Flood Control

Neither Santa Barbara County nor Ventura County does regular channel maintenance in Rincon Creek. The watershed is shared by the Counties; however, the two agencies have not reached an agreement on how to split maintenance responsibilities. Some regular bank stabilization maintenance is handled by the Caltrans in areas where highways cross or run parallel to the creek.

7.8.3 Fish Barrier Removal Projects

A detailed analysis of the Highway 101 culvert was conducted in the *Preliminary Plan Formulation Report for the Rincon Creek Aquatic Ecosystem Restoration Project Santa Barbara/Ventura County* (MEC Analytical Systems, Inc. 2001). Since this study was completed, several alternatives to remediate the fish passage issues within the culvert have been considered. Recent information is summarized below.

In 2005, the USACE was considering the following alternatives (Louie 2005):

- No action
- 2 percent slope with concrete or rock weirs
- 4 percent slope with boulder ramps
- 8 percent slope with boulder ramps

At that time, additional topography surveys of the area upstream of the culvert were needed to proceed. Under Section 206 of the Continuing Authorities Program (CAP), only projects that were named by Congress to receive funds are funded. Since the Rincon Creek Highway 101 culvert project was not named by Congress, the project did not receive federal funding for fiscal year 2006.

Caltrans has been dedicated to remediating the Highway 101 culvert since 1989 (Cesena 2007). As of September 2006, Caltrans was working on a design to alter the culvert inlet to allow for fish passage. The current plan for the Highway 101 culvert is to remove the upstream inlet, regrade the area, and install a series of step-pools (Cesena 2006). Installation of the upstream step-pools would require landowner approval. No additional retrofits of the remaining areas of the culvert will be performed until this initial phase of upstream inlet modification is completed.

After the upstream apron is removed, Caltrans will perform monitoring to determine if steelhead are able to migrate through the culvert into upstream habitats. Caltrans has also completed hydrologic studies of the planned upstream culvert removal to determine how the project will affect debris flow in the culvert. Since upstream of the culvert is designated as floodplain, Caltrans cannot implement any project that would decrease the flow capacity of the Highway 101 culvert.

7.8.4 Forest Service

Information regarding Forest Service management activities was gathered through a personal communication with Jim Webb of the Forest Service (Webb 2007). The Rincon Creek watershed lies on the boundary between the Santa Barbara Forest Service district and the Ojai Forest Service district. The Forest Service has two off-road vehicle routes that enter into the Rincon Creek watershed; both are near the ridge line. The Forest Service has two fuelbreaks within the watershed (Figure 1-2). Maintenance of the fuelbreaks is performed on an as-needed basis. There is a grazing allotment in the watershed; however, it has been vacant for at least the past 15 to 20 years. Southern California Edison also has permits for two transmission lines and three short segments of road within the watershed, which they perform maintenance on when repairs are needed. The Forest Service has not conducted controlled burns historically within the watershed and there are no future plans to conduct them.

7.9 RECENT DEVELOPMENTS

7.9.1 Casitas Landslide

During the May 2006 survey a major landslide within Casitas Creek was noted at the upstream end of the survey area (Figure 1-1). In November 2006, the CEC and Tetra Tech met with a project engineer that is restoring this area. A summary of the information gathered during that meeting is provided here.

This 750 foot long stretch of stream has historically experienced landslides. Several slides occurred in the spring of 2005, moving rip-rap that had been previously installed. In the spring of 2006, the area was repaired under emergency permits. At this time, the channel was realigned and plastic and rip-rap were temporarily installed.

By November of 2006, the emergency measures (plastic, etc.) had been removed and habitat restoration efforts were underway. Waddles, biodegradable erosion blankets, and three rock weirs had been installed. The area had been reseeded and planted with cuttings (willows) and container plants (sycamores). Additional habitat restoration efforts are planned for the fall of 2007. Work within the project site is being done under various permits. If in 5 years the site has not met the habitat restoration criteria of these permits, the site will be turned over to the Ojai Valley Land Conservancy.

The goal of the work in this area is to reduce the risk of landslide at the site. However, the situation is complicated by the fact that the project site, access road with culvert, and hillslope are owned by separate groups. The regrading and channel alignment work has been conducted within the area upstream of the road and culvert, no work is authorized within the culvert and hillslope area.

During fieldwork conducted in May 2006, it was noted that Casitas Creek contained highly turbid water both downstream and upstream of this landslide area.

7.9.2 Weather Conditions

In January 2007, Santa Barbara and surrounding counties experienced a series of days with severe weather that caused significant crop damages. Over a two-day period, high winds caused an estimated $20 million in damages to crops in Santa Barbara County alone, affecting primarily avocado growers (Santa Barbara County Agricultural Commissioner’s Office 2007). Over a different four-day period, crops such as avocados, broccoli, celery and strawberries sustained an estimated $20 million in damages when nightly temperatures dipped below freezing (Santa Barbara County Agricultural Commissioner’s Office 2007). Santa Barbara County applied for and received disaster designation from the federal government, which enables affected farmers to apply for low-interest federal loans from the U.S. Department of Agriculture’s Farm Services Agency. Growers anticipate that a number of farm workers may be out of work during the spring 2007 harvesting season. California food banks and the California Department of Social Services have instituted assistance programs to help meet the food needs of farm workers and their families during this time.

Many of the growers within the Rincon Creek watershed were affected by these conditions. Some landowners have indicated that between 20 to 40 percent of their avocado crops may have been lost and additional damage to the trees also occurred.

8.0 GIS

The following GIS layers were provided by the County of Santa Barbara and were utilized in the development of the watershed plan:

- Topography
- Soils
- Geology
- Fire History
- Streams
- Ocean monitoring sites
- Land use zoning designations
- Flood hazard
- FEMA floodplain zones
- Rincon Creek watershed boundary

Aerial photographs from 2000 were also provided at a 3 meter pixel resolution by Santa Barbara County. Field data points were collected using a hand-held GPS (accuracy up to 3 meters).

The GIS layers and data described above were compiled into a GIS application, which was used to develop the various figures and maps provided within the watershed plan.

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9.0 CONCLUSIONS

9.1 SUMMARY OF KEY ISSUES

9.1.1 Erosion/Sedimentation

The Rincon Creek watershed is an erosional landscape set in a mountainous terrain. The watershed is inherently unstable due to rapid tectonic uplift, active faults, very weak rocks, and steep slopes. Landslides, debris flows, bank erosion and excess sedimentation are common in the watershed. Land use practices including modification of stream channels, road building, and stream side agricultural activities have compounded the naturally-unstable conditions in many parts of the watershed.

The majority of the geomorphic and ecologic limitations in the Rincon Creek channel stem from a large number and frequency of active erosional processes on the hill slopes (hill slopes with high channel connectivity in particular), lateral instability along the creeks, and agricultural diffuse sediment sources. Rincon Creek is a naturally erosive creek and certain amounts of bank erosion are a natural process. However, the magnitude and frequency of erosional processes have increased due to land use practices that encroach onto stream channels.

The geomorphic and ecologic limitations in the Casitas Creek channel stem from system-wide degradation. These limitations in Casitas Creek also contribute to the limitations along Rincon downstream of the confluence. The key issues in the Casitas Creek watershed are bed incision and subsequent bank erosion. Casitas Creek channel has undergone severe bed incision in the recent past. Agricultural development in both the Rincon and Casitas Creek watersheds, coupled with residential development and road building have altered the hydrology and creek dynamics. The banks along the channel have grown high and steep, become unstable, and have collapsed. The channel is not expected to incise further at a rapid rate due to siltstone outcrops throughout the bed (except infrequent and high flows). However, bank erosion along the channel is expected to be a significant process and Casitas Creek is expected to continue to provide significant amounts of sediment until the channel reaches a new equilibrium width and depth.

While both Rincon and Casitas Creeks are laterally unstable, Casitas Creek channel has undergone a more severe degradation at a faster pace. The geology and soils in the Casitas Creek watershed are weaker and more erodible, and therefore create conditions conducive to hillslope and channel erosion. Superimposed on these naturally unstable conditions are the current agricultural practices that are unfavorable to channel stability.

Watershed alterations do not need to be at a large scale or have an abrupt or evident impact to modify creek dynamics and adversely impact channel conditions. A bank may be stable for decades, and then start to erode because of either changes in rainfall or drainage pattern or more subtle changes such as a disruption in upstream sediment supply. A poorly designed bank stabilization effort with local focus may cause the water leaving the reach to accelerate, potentially creating greater erosion downstream. The cumulative impact from several minor channel alterations and stabilization efforts upstream of a given reach is the change that results from the incremental impact of each project, and can be significant.

Altered hydrology in the watersheds that resulted in bank erosion along Rincon and incision along Casitas created the need for bank protection. There are several bank protection measures along the channels. The majority of these measures is failing or is incompatible with the upstream and downstream bank protection structures. Many of these structures are ‘band-aids’ that address the visible local problem condition without addressing the source of the problem, the active physical processes. Bank stabilization and protection efforts within the study area range from pipe and wire revetments (Figures 7-4A and 7-4B, waypoint 44) to professionally-designed riprap structures (Figures 7-4A and 7-4B, waypoints 56 and 58) to ad hoc assemblages of miscellaneous materials (mostly concrete rubble). A consistent problem with much of the ad hoc treatments is that the concrete rubble have been applied to or on top of the bank often constricting channel dimensions, altering flows, and potentially triggering erosion on the opposite bank or downstream. The bank stabilization efforts are typically not keyed into the channel bed to the predicted scour limit, or to adjacent banks making them susceptible to undercutting, flanking and ultimately premature failure (Figures 7-4A and 7-4B, waypoints 56 and 58). Sustainable and adequate channel and bank protection can be achieved through well-designed and cost effective approaches that are consistent with and potentially enhance creek function and habitat values. Such measures should seek where possible to reduce the erosive energy of the stream, as well as increasing the resistance of the banks. An advantage of this approach is that reducing erosive energy allows the use of more environmentally-friendly bank stabilization techniques (often referred to as biotechnical bank stabilization) that increase the biological and aesthetic value of the creek.

9.1.2 Steelhead Habitat

Within Rincon Creek from the Highway 101 culvert upstream to the confluence with Casitas Creek has reaches of fair and good steelhead habitat. However, this area is also characterized by highly turbid water, which lowers the habitat value. Upstream of the confluence, Rincon Creek contains good and very good habitat for steelhead, and is characterized by clear water. This habitat exists from the confluence upstream to the rock quarry.

Casitas Creek contains poor, fair, and good habitat for steelhead. However, the entire length of Casitas Creek has highly turbid water. Given the sedimentation issues within Casitas, it does not represent high quality steelhead habitat. Overall, Rincon Creek provides higher quality steelhead habitat than Casitas Creek.

The highly turbid water within Casitas Creek is reducing the quality of steelhead habitat. The sedimentation within Casitas Creek degrades the habitat quality within Casitas Creek and within the lower Rincon Creek mainstem. As a result, steelhead habitat in upper Rincon Creek is of higher quality than that of lower Rincon Creek. Any reduction of sedimentation in Casitas Creek would improve the steelhead habitat quality not only within Casitas Creek, but also within the lower Rincon Creek mainstem. Therefore, projects that would reduce sedimentation within Casitas Creek would have the added benefit of improving the steelhead habitat within the downstream area of Rincon Creek.

9.1.3 Barriers to Upstream Steelhead Migration

Rincon Creek currently contains 11 barriers to steelhead migration, only one of which is natural. Of particular importance for steelhead is the Highway 101 culvert. This barrier is impassable by steelhead under all flow conditions and currently blocks steelhead from 4,050 meters of habitat within Rincon Creek.

Casitas Creek contains 5 barriers, of which one is natural. Many of these barriers are rated as extremely severe barriers and one is impassable by steelhead. Given the lower habitat values and sedimentation issues together with the severe migration barriers, Casitas Creek should be a low priority for the restoration of steelhead habitat. However, projects that would reduce sedimentation within Casitas Creek would also improve the downstream steelhead habitat within Rincon Creek.

9.1.4 Water Quality

There are ongoing efforts to monitor water quality within the lower Rincon Creek watershed. The watershed has shown elevated nitrogen and phosphorus levels, boron levels that may be toxic, ammonia at concentrations toxic to aquatic life, elevated bacteria levels, and sedimentation occurs within Casitas Creek and lower Rincon Creek.

9.1.5 Non-Native, Invasive Plant Species

In comparison to other watersheds, the presence of giant reed within the Rincon Creek watershed is relatively low. Other species that are present in high numbers are ivy and nasturtium. There are lower numbers of other non-native, invasive plant species, including castor bean, eucalyptus trees, pampas grass, and tree tobacco.

Non-native, invasive plant species can cause a range of impacts. A reduction in native plant species and habitat can occur, which also reduces wildlife habitat and food. Ivy, nasturtium, and giant reed will often completely overtake areas, resulting in monostands that are completely dominated by these species. These species also have shallow roots, which can result in increased erosion and sedimentation. In areas heavily infested by these species, riparian habitat may also be lacking, which can lead to many other issues. For example, areas lacking an intact riparian also often have reduced canopy closure, which can lead to increased temperature and a resulting decrease in dissolved oxygen. Increased temperature and decreased dissolved oxygen levels are detrimental to steelhead. Given the connectivity between the presence of non-native, invasive plant species and other key watershed issues (steelhead habitat, riparian habitat, etc.), the presence of these species in the watershed should be monitored and controlled when feasible.

9.1.6 Riparian Corridor

Rincon and Casitas Creeks contain areas that are lacking an intact riparian corridor. At times avocado trees are present on the creekbanks, in other areas rip-rap is present. Pipe and wire revetment also occurs, sometimes with vegetation and sometimes without. There are also areas with large landslides that are lacking vegetation. Casitas Creek is lacking an intact riparian corridor throughout the majority of the length surveyed. Rincon Creek contains better riparian habitat, although there are also long stretches that lack riparian habitat.

The riparian corridor is an important, diverse, and productive ecosystem. Riparian areas play a vital role in maintaining the stability of a watershed. A well-vegetated riparian corridor service a number of valuable functions for flood control. Low-lying floodplain areas next to stream channels combined with riparian vegetation reduce the water velocity and allow floodwaters to spread out through the riparian corridor and re-enter the main channel slowly. Riparian vegetation also uses large amounts of water in the process of transpiration, which increases the overall water holding capacity of the floodplain soil. Riparian areas also provide valuable habitat for a variety of plant and wildlife species. Wildlife may also use riparian areas as a movement corridor.

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10.0 RECOMMENDED PROJECTS

Projects have been recommended in order to assess the key issues identified in the watershed. Projects are not presented in any particular order; Section 11.0 contains a prioritized list of projects.

10.1 STRUCTURAL SOLUTIONS TO REDUCE EROSION/SEDIMENTATION

Lateral instability in the Rincon Creek watershed stems from two main reasons and an appropriate stabilization approach needs to consider the underlying causes, which are described below.

Channel banks erode because the channels migrate laterally into a bank, or impinging water is directed from a straight reach onto a bank. This type of locally-derived erosion is common along Rincon Creek and can be controlled by increasing the erosion resistance of the bank or, if possible, by decreasing the shear stresses induced by flows higher than a certain threshold. Planting vegetation on the bank toe or adding toe protection would increase the erosion resistance of the bank. If the banks are high, regrading the bank to a more stable angle would increase bank resistance as well as decrease shear stresses by increasing the channel cross sectional area.

Banks slump and fail because the channels are cutting downwards, leaving the banks too high to remain stable. This type of watershed-wide erosion exists in Casitas Creek. Casitas Creek is a small system and, unlike Rincon Creek, does not have a confined valley floor. However, it has incised in response to the hydrologic changes partly due to human encroachment and has become disconnected from its floodplain. As the channel has incised, its banks have grown higher and steeper and become unstable. The bank instabilities along Casitas Creek are system-wide and can be best addressed by a wider-scale treatment option. In general, the best treatment in an entrenched channel that has incised and is currently undergoing widening is to reestablish channel-floodplain connectivity by lowering its floodplain, replanting native vegetation, and creating a buffer that would minimize future encroachment. Alternatively, the channel can be left alone to recover naturally without any streamside agricultural or urban activity, bank stabilization or channel repair. This process may take a couple of decades or longer and would, involve loss of streamside property and temporary loss of riparian cover.

The geomorphic analysis developed structural solutions designed in order to improve overall channel function, stability and bank erosion while enhancing habitat values. These elements either reduce stresses on the system or increase resistance of system components. For instance, while bank regrading or floodplain inset bench lowering would reduce stresses along the banks, toe stabilization measures would increase the resistance of the banks.

The structural solutions identified below are conceptual approaches to address certain types of stability problems in the watershed. Actual projects can be based on these conceptual approaches if supplemented by additional site investigations and analysis, potentially including more detailed site surveying, geotechnical investigation and analysis, and an analysis of hydraulic conditions and shear stresses along the study reach.

Future design of stabilization and enhancement projects along Rincon and Casitas Creeks should be developed from a watershed and geomorphic perspective, taking into account the cause of erosion and differentiating between accelerated erosion threats and natural erosion.

10.1.1 Project SED-1: Toe Stabilization of Large Erosional Features

The geomorphic reconnaissance identified locations where as stream flow washes against steep, high, unprotected bends it undercuts the banks, causing slumps and landslides. Erosional features and landslides greater than 20 feet high were characterized as "large" erosional features.

A conceptual solution to large sized erosional features is toe stabilization. Toe stabilization includes a range of measures that aim to reduce or in some cases stop movement by preventing future erosion of the bank toe. However, it is important to note that some of the large erosion features noted in the field appear to be deep-seated landslides that require geotechnical investigations that were not part of this investigation. Some of these features appear to require major geotechnical stabilization.

Figure 10-1 illustrates a conceptual approach to toe stabilization. If regrading is not feasible, this approach involves placing rock armor on the toe. The rock should go no more than 6 feet up the bank in most cases, and should be placed by hand or a skilled equipment operator rather than tipped, with trees planted in tubes through the rocks. The rocks should be keyed well below the active channel to prevent scour (at least 2-3 feet). Live pole cuttings of native riparian tree species can be built into the rock section and ultimately establish and grow into the bank. The rock provides structural stabilization to the creek channel while the trees will enhance soil stabilization and riparian habitat. Vegetated rock is effective in increasing channel roughness, slowing flow velocities and reducing sheer stresses.

The geomorphic analysis estimated the effectiveness of toe stabilization projects in the watershed (see Appendix A). Sediment load contributions from two large landslides (Figure 7-4A, waypoints 77 and 48) were compared to the estimated total sediment yield of the watershed. The total sediment yield was estimated by relying on several previous studies in the region have estimated sediment yields from watersheds with similar physical characteristics. The volume of sediment contributed from large landslides was estimated by measuring the approximate length, width, and depth of the features. Landslides at waypoint locations 77 and 48 appear to be contributing 0.6 to 2.3 percent of the total sediment yield, respectively. Therefore, stabilizing five of these large slides can reduce sediment input up to 10 percent.

Implementation of toe stabilization methods could be applied at any of the large erosional features identified within Rincon and Casitas Creeks (Figure 7-4A) with more detailed, site-specific geotechnical evaluations.

10.1.2 Project SED-2: Biotechnical Stabilization of Medium Eroded or Unstable Banks

The geomorphic reconnaissance identified erosional features and landslides that are less than 20 feet high and characterized them as "medium". A conceptual solution to medium sized landslides is biotechnical stabilization. Biotechnical stabilization includes a range of measures that integrate structural materials such as rock with live plant materials to stabilize and revegetate creek banks.

Biotechnical stabilization can potentially be applied to medium erosional features. In the Rincon Creek watershed context, this would likely involve terracing or regrading the bank to a stable angle (maximum 2:1 [horizontal:vertical]) and the installation of large rock to armor and protect the channel bank toe below the calculated scour level. Live pole cuttings of native riparian tree species (willows) can be built into the rock section and ultimately establish and grow into the bank. The rock provides structural stabilization to the creek channel while the trees will enhance soil stabilization and riparian habitat. Vegetated rock is effective in increasing channel roughness, slowing flow velocities and reducing sheer stresses. It is also valuable to plant native riparian trees at the banktop where possible. Native species will help to anchor and stabilize soils, slow erosion, and provide valuable riparian habitat.

Figure 10-2 illustrates a conceptual approach to biotechnical bank stabilization for a medium erosional feature. The design and installation of biotechnical stabilization to a project site requires additional technical engineering analysis and design. Design and implementation of the rock toe is aided by the integration of a more detailed geomorphic assessment and requires grading of the affected bank to key the structure into the channel and banks. The rock section must be designed to accommodate predicted scour to protect the installation from under-cutting and should be designed to the bankfull elevation. The scour level varies from site to site, but is likely to be at least 2-3 feet.

For areas that are not exposed to highly erosive conditions, biotechnical stabilization can be applied without incorporating rock structures. Structural materials would only be used in the short term while integral live cuttings establish and root throughout the creek bank. As the live materials establish, the roots provide long-term stabilization to the soils, the vegetation reduces flow velocities and sheer stresses on the bank surface and provides cover for habitat.

The potential benefits of implementing a bank stabilization project were evaluated for one location within Casitas Creek (Figure 7-4B, waypoint 103). The impacts of regrading a bank to a 2:1 angle were evaluated by estimating shear stresses at a surveyed cross-section at the downstream end of Casitas Creek (Figure 7-4B, waypoint 103). Shear stresses were estimated for existing bank conditions (a bank angle of 0.35:1) during a flow of approximately 1,000 cfs (flow with an approximate recurrence interval of 10 years). Shear stresses at the same cross section were evaluated assuming that the left bank is graded to a 2:1 angle. Shear stresses, and therefore flow erosivity, decreased 15 to 20 percent due to the regrading of one bank along Casitas Creek. This illustrates the benefit of bank stabilization that addresses the causes of erosion by reducing shear stresses as well as increasing shear resistance. By incorporating regrading and floodplain terraces into bank stabilization designs lower shear stresses would be generated, reducing net erosion and allowing more environmentally-friendly bioengineering materials to be used.

Implementation of the bank stabilization methods could be applied at any of the medium erosional features identified within Rincon and Casitas Creeks (Figure 7-4A) with more detailed, site-specific geotechnical evaluations.

10.1.3 Project SED-3: Creation of Floodplain Inset Bench

A floodplain inset is a broad flat terrace that is created by excavating within a determined restoration zone. The floodplain width is typically defined and limited by adjacent landscape features. Figure 10-3 shows a potential location to incorporate a floodplain inset bench on the right bank along Rincon Creek (as facing upstream). However, this project is also recommended for any location within Casitas Creek. Figure 10-4 illustrates a conceptual approach to a floodplain inset bench feature. In the conceptual approach presented, the floodplain width would be constrained by:

- Hill slopes flanking the right bank (as facing upstream).
- Desired width of agricultural land at the site.
- Adequate hydraulic conditions along the inset bench during high flows.

The floodplain bench would be excavated along the bank to create more diverse riparian conditions including a seasonal, meandering low-flow channel and banks vegetated with native riparian trees. The floodplain bench may be approximately three feet above the channel invert based on the predicted water surface elevation during the 2-year flow.

A simple quantitative estimate for the benefits of creating a floodplain inset bench is not available. Such an estimate would require hydraulic and shear stress modeling at surveyed and connected cross sections. The impacts of regrading the bank to a 2:1 angle (minimum) were evaluated by estimating shear stresses at a surveyed cross-section at the downstream end of Casitas Creek (Figure 7-4B, waypoint 103) and comparing potential shear stresses to those for existing bank conditions during a flow of approximately 1,000 cfs. The results indicated that shear stresses would decrease by 15 to 20 percent with regrading of the right bank (as facing upstream) to a stable angle. The decrease in shear stresses would correspond to a similar decrease in the erosive power of the flows. These results illustrate the benefits of regrading banks at a cross section. The benefits of creating a floodplain inset along a more extensive reach would be even more pronounced. An extended floodplain inset would store more flood flows, would result in a more significant reduction in the peak flows, and would ultimately lead to more stable bank conditions.

10.1.4 Project SED-4: Bed Stabilization of Tributaries

Incision of Rincon Creek and Casitas Creek is likely to cause bed level changes along the tributaries of both channels. During the geomorphic reconnaissance, several “hanging” tributaries with a higher bed elevation than Rincon or Casitas Creeks were observed (for example, Figure 7.4B, at waypoint 81). These tributaries join the main channels with a couple of feet of elevation difference in grade at times.

These tributaries can be stabilized to prevent future incision by using grade control structures. Grade control structures can be utilized at the confluence and upstream where feasible (e.g. at Long Canyon). Grade control structures can help to stabilize channel banks by raising bed levels and limiting the potential for undercut banks. They are typically constructed from rock, concrete or large wood elements and are built across the entire channel. They should be keyed into channel banks to prevent scour and flanking.

These structures can have profound hydraulic affects and must be considered and designed carefully. In high energy creeks like Rincon Creek, grade control structures must be constructed of materials that can resist the extreme hydraulic environment and should address energy dissipation, incision, and habitat quality. In Rincon Creek, large rock or structural concrete weirs may be the preferred materials. Grade control structures should be constructed in straight sections of the creek channel and generally should not be built on channel bends. Care should be taken that grade control structures do not in themselves become fish migration barriers.

10.2 NON-STRUCTURAL SOLUTIONS TO REDUCE EROSION/SEDIMENTATION

Non-structural solutions mostly consist of commonsense practices, focused impact reducing recommendations, agricultural Best Management Practices (BMPs), and projects that would provide additional data. The non-structural solutions listed below are a set of recommended approaches to minimize streamside activities that exacerbate existing instabilities or to emphasize activities that assist in stabilizing channel conditions.

10.2.1 Project SED-5: Implementation of Best Management Practices

Physical Isolation of Creek Banks

Channel banks in the watershed are unstable. Staying away from the banks as much as possible and reducing streamside activities to a minimum would diminish further degradation and would support channel recovery.

Elimination and Prevention of Concentrated Runoff Diversions

Pipes or culverts can disrupt bank gradients and stabilize streams for extensive distances. If pipes are put in at an angle that deviates from the channel's equilibrium slope or where concentrated runoff coming out of pipes are directed on the banks, there will be erosion at, upstream, and downstream of the pipe location. It is recommended that additional flows are minimized and that, where inevitable, flows are conveyed to the creek through an appropriately designed pipe set in a strengthened location.

Improving Infiltration Conditions

Increased runoff in the creeks increases the sediment transport capacity of the channel, eroding sediment from the channel bed or banks and increasing its width and depth. Impervious surfaces and certain agricultural practices that compact the soil reduce the amount of infiltration to the ground, increasing runoff. Management and reduction of impervious surfaces and soil compaction would increase infiltration conditions and would go some way towards reducing channel instability.

Protection of Ground Cover in Orchards

Mature orchards which have well-constructed, properly contoured access roads and have intact ground cover will have minimal erosion under most conditions. Newly planted orchards, without groundcover are very susceptible to erosion from runoff. Therefore, it is recommended that ground cover is maintained in mature orchards and is enhanced through BMPs in new orchards.

Avoidance of Land Clearing and Road Construction on Steep Slopes

Land clearing and construction of farm roads, especially on steep slopes, can be the starting point of gullies. Land clearing removes the vegetative cover, reduces resistance to erosive forces, and makes surfaces more susceptible to erosion. Vegetative cover is recommended to be maintained and enhanced especially on steep slopes. Similarly, poorly located and poorly constructed roads on steep gradients can result in conditions that trigger erosion. Roads that are located on less steep slopes would have less impact on erosion conditions than those constructed on steep slopes. Well designed roads would be sloped so that stormwater runoff drains to the sides of the roads and into vegetated areas where the stormwater will be slowed down, filtered, and infiltrated.

Incorporation of Agricultural BMPs

Agricultural BMPs are individual and systematic approaches aimed at reducing or minimizing erosion impacts from agricultural lands as part of an overall watershed approach. Agricultural BMPs are described below.

- **Contour farming:** farming sloping land so that crops are cultivated across slopes with the contours of the land instead of up and down slopes in order to reduce surface runoff and erosion. This practice is especially relevant to orchards and other fruit areas.

- **Terracing:** Constructing an earthen embankment, channel, or a combination ridge and channel constructed across the slope to reduce erosion and sediment content in runoff water.

- **Critical area planting:** Using trees, shrubs, vines, grasses, or other vegetative cover to control soil movement and protect the soil surface from wind erosion when adequate cover does not exist.

- **Filter strips:** A filter strip of lush vegetation between nonpoint sources of pollution and water courses, which slows down the flow and turbulence of water allowing suspended material to settle out. This practice includes field borders. Vegetated filter strips (forested or grass) are effective in the removal of sediment from cropland runoff.

10.2.2 Project SED-6: Roadway Sediment Source Assessment

A study that analyzes the contribution of sediment from roads and other sources is recommended. Once the major sources of sediment to Rincon and Casitas Creeks are identified, erosion control measures and other solutions can be developed and implemented to reduce sediment input to the watershed.

10.2.3 Project SED-7: Increased Education Regarding Sediment Control Methods

During development of the watershed plan, landowners indicated that additional education regarding sediment control methods would be helpful. It is recommended that educational outreach activities be conducted to assist landowners in minimizing the erosion occurring within their property. Particular focus should be placed on landowners in Casitas Creek.

In June 2007, a workshop is planned that will focus on avocado growers, including those in the Rincon Creek watershed. Included within the workshop topics are erosion control methods. The workshop is being held at the Refugio Creek Ranches and is sponsored by the Cachuma RCD, Santa Barbara County Water Agency, California Department of Conservation, Ventura County UC Cooperative Extension, Santa Barbara County Agricultural Watershed Coalition, and the SWRCB/RWQCB Prop 50 Grant Program.

10.3 NON-NATIVE, INVASIVE PLANT SPECIES

As described in Section 7 and shown in Figures 7-12A and 7-12B, there are several non-native, invasive plant species within the watershed. Removal of these species would help to restore the riparian corridor and improve native habitats used by plants and wildlife.

Development and implementation of a non-native, invasive plant species removal program is recommended. Any removal of non-native, invasive species should be implemented from an upstream to downstream direction. In addition, a watershed-based approach will ensure that an overall strategy for removal is being implemented. Following removal efforts, habitat restoration activities may be required in order to minimize soil loss, restore the riparian corridor, and prevent reestablishment of other non-native species.

Recommendations regarding non-native, invasive plant species are described below.

10.3.1 Project WEED-1: Vegetation Management Plan

It is recommended that a comprehensive, watershed-wide Vegetation Management Plan be developed. A key aspect of the plan will be to map the presence of Cape ivy in the watershed, relying upon aerial photographs when possible and to develop methods to initially prevent Cape ivy from spreading. Appropriate methods for removal and containment of non-native, invasive plant species should be developed within the Vegetation Management Plan. Involvement of the Forest Service in the development of the Vegetation Management Plan will be crucial, given that much of the upper watershed is within Forest Service land. Development of a watershed-wide plan will allow for a coordinated removal and containment effort. Methods for monitoring the progress of non-native, invasive plant species containment and eradication efforts should be included within the Vegetation Management Plan.

A Ventura County Weed Management Area is currently under development. One strategy is to develop a Memorandum of Understanding between Ventura and Santa Barbara Counties which would allow for the entire watershed to be placed under the jurisdiction of the Ventura County Weed Management Area.

10.3.2 Project WEED-2: Giant Reed Eradication

Approximately 112 separate locations of giant reed, covering approximately 2.5 acres, were previously mapped in Carpinteria Creek (Cachuma Resource Conservation District and Carpinteria Creek Watershed Coalition 2005). Rincon Creek has a relatively few occurrences of giant reed by comparison. In Rincon Creek, nine locations were mapped in May 2006, all of which are in the lower 1.6 miles of the stream. Given the small magnitude of the current giant reed infestation, an aggressive eradication program could eradicate this species from the watershed. There are two main alternatives to eradicate the species: pursue inclusion in a biocontrol study or use traditional removal methods.

Tom Dudley with UCSB has been researching biological approaches for controlling invasive riparian plants, including giant reed. Biological control approaches involve the use of natural predators (insects, fungi). His preliminary findings regarding biological control of giant reed are (Dudley *et al.* 2006):

- Costs are inexpensive, as compared to traditional mechanical and chemical control methods.
- Can be used in hard-to-reach areas.
- Environmentally benign.
- Is a form of sustained control.
- Benefits the ecosystem by providing food resources for wildlife.

Field cage trials of giant reed biocontrol methods began in 2007 and open release of the methods may occur by 2008 (Dudley 2007).

At the third upstream occurrence of giant reed, the landowner has expressed a willingness to participate in a giant reed biocontrol demonstration project. This landowner is an organic grower, so biocontrol methods would be advantageous.

If implementation of a giant reed biocontrol program is not feasible, traditional removal methods could be implemented. The Santa Barbara County Agricultural Commissioner's Office is currently implementing a similar program in Carpinteria Creek. In this program, herbicides are applied (using a cut-stump method or foliar method). In the cut-stump method, the plants are cut close to the ground and herbicides (glyphosate at 50-100 percent concentration) are applied directly to the stump (within 3 minutes of cutting). In the foliar application method, herbicide is applied to the entire plant and the dead plants are removed approximately 6 weeks following application. An additional removal method is to cut and dig the plants out and not apply herbicides. This method can be labor intensive. Follow-up treatments and monitoring are required under all methods.

10.3.3 Project WEED-3: Ivy and Nasturtium Eradication

A watershed-based approach to remove of ivy (Cape and English) and nasturtium is needed. Both species are fast spreading, and require a diligent approach, since all stems and stem fragments must be removed or treated. Traditional methods of removal rely on hand-removal by using a small rake, however, repeated monitoring must be undertaken to ensure that all plant fragments have been removed. Herbicides can also be used to treat resprouts. Solarization can also be used as an alternative to herbicide treatment. Biological control methods for Cape ivy are currently under development. Once these methods are approved, Rincon Creek could employ them to control and possibly eradicate Cape ivy.

During the May 2006 survey it was noted that ivy and nasturtium occur at a very high frequency within the watershed. A successful removal program would need to be watershed-based and would require years of ongoing efforts to control these species. Monitoring would also be required for many years.

10.3.4 Project WEED-4: Education Program

In several locations within the creek, ornamental vegetation was overhanging banks and invading the riparian habitat. Landowners should be encouraged to plant native vegetation. Several educational tools, such as "Don't Plant a Pest Brochure", which list native plants to plant instead of non-natives are available. This brochure is currently available on the RCWC website. Regular updates on the progress of projects WEED-1, WEED-2, and WEED-3 should be posted on the RCWC website.

10.4 RESTORATION OF THE RIPARIAN CORRIDOR

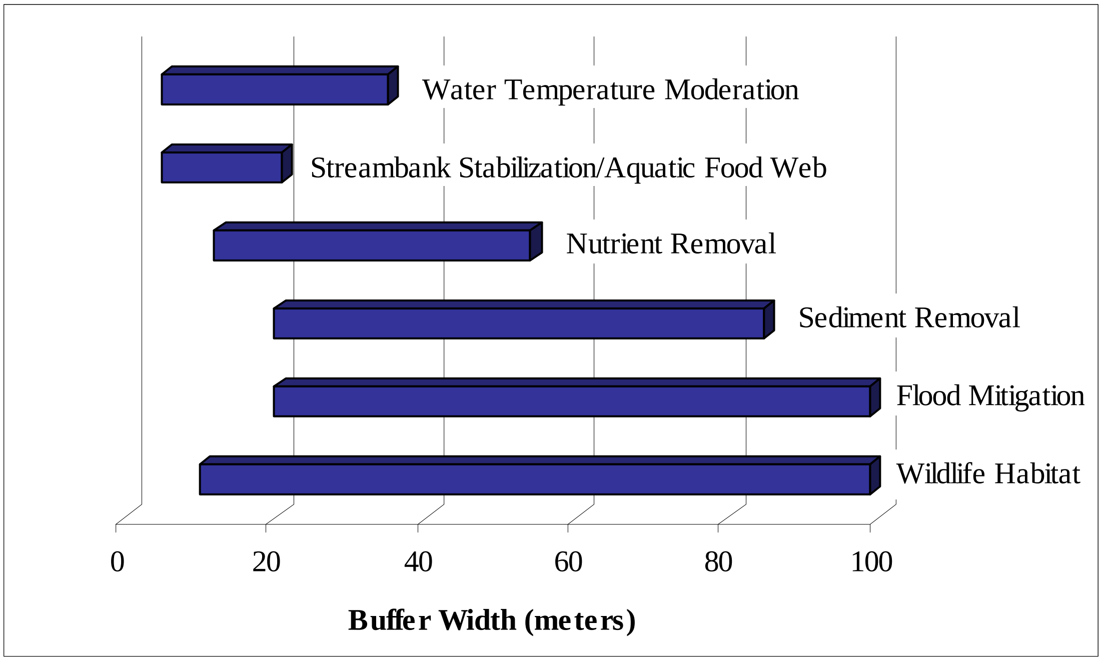
Rincon Creek is lacking an intact riparian corridor throughout much of its length (Figures 7-13A and 7-13B). Ideally, Rincon and Casitas Creeks would contain streamside buffers between the creek and anthropogenic activities.

Streamside buffers serve as natural boundaries between local waterways and existing land use practices, and help protect resources by providing flood control, alleviating streambank erosion, filtering pollutants, and providing room for lateral movement of the stream channel. Streamside buffers provide natural flood control and protection by functioning as a giant sponge to slow down and regulate flood waters. They hold streambanks in place, protecting property owners from damage. Streamside buffers on flat areas can also be effective in removing sediment and nutrients. They also serve an important purpose of providing food, shade, and structural habitat features for aquatic and terrestrial species.

Riparian vegetation along streamside buffers limits the rate of channel migration by either increasing bank strength or increasing channel roughness. Riparian vegetation strengthens banks by reinforcing bank soils with roots or by providing large woody debris for incorporation into bank materials. When native bank vegetation is removed, bank strength and protective cover are decreased and the hydraulic roughness of the channel is reduced, which shifts the peak near-bank velocities downstream (Micheli *et al.* 2004).

Previous research had shown that for a small set of midwestern study reaches, channels bordered by riparian forest tended to migrate roughly half as fast as unforested channels (Johannesson and Parker 1985; Odgaard 1987). Recent research along Sacramento River showed that the central reach of the Sacramento River tends to migrate more quickly through agricultural land than through riparian forest. These results indicated that removal of riparian forest vegetation along the Sacramento River appears to accelerate migration rates and increase bank erodibility by roughly 80 to 150 percent (Micheli *et al.* 2004).

Within Rincon and Casitas Creeks, creation of a protective streamside buffer would isolate the creek channels from future disturbances or encroachment. Typically, the width of the streamside buffer depends on the site-specific conditions and stream functions that are being addressed and restored. Graphic 10-1 summarizes the functions of buffers and the range of minimum widths needed to achieve them. The primary functions needed to protect and restore Rincon and Casitas Creeks are streambank stabilization, margin for stream movement and meandering, and sediment removal. As shown in Graphic 10-1, a 100 foot (30 meters) total riparian buffer width is recommended. This width is supported by research in numerous publications of scientific literature (Schueler and Holland 2000, Todd 2000, Castelle and Johnson 2000).



Graphic 10-1: Relationship Between Desired Buffer Function and Minimum Width
Source: Adapted from Todd 2000

Field observations corroborate the benefits of a minimum total buffer width of 100 feet. The geomorphic assessment identified stable reaches along Rincon Creek. It was noted that these stable reaches were typically lined with a riparian corridor width of approximately 50 feet from the bank top. Where Rincon Creek has a buffer width of approximately 50 feet along a single bank or a riparian corridor width of approximately 100 feet, the system is stable. Therefore, implementation of a 50-foot wide streamside buffer along Casitas Creek study reach, and along Rincon Creek where feasible, is recommended.

It is acknowledged that the establishment of a 50 to 100 foot wide streamside buffer along Rincon Creek and Casitas Creek would be a long-term undertaking. Therefore, key projects that would restore large sections of the riparian corridor are described below and are recommended as a starting point to restore the riparian corridor within the watershed.

10.4.1 Project RIP-1: Restoration of Riparian Habitat

As shown in Figures 7-13A and 7-13B, there are several stretches within Rincon and Casitas Creek where the creek banks are planted with avocado trees. In many cases there is no native riparian vegetation and avocado trees are overhanging the creek. Removal of these avocado trees and replacement with native riparian vegetation is recommended. In many cases, this removal and restoration will require an assessment to determine appropriate engineering approaches to bank stabilization. Stretches of both creeks contain areas with previous engineering attempts to stabilize the banks (rip-rap, wire revetment). In many cases, removal of avocado trees can be combined with the biotechnical stabilization methods described within Section 10.1.

An approach that should be considered is the formation of a landowner cooperative to jointly manage the riparian area. The formation of a cooperative would allow for the pooling of financial resources to obtain grant funding. It would also allow for a prioritized approach to riparian habitat restoration.

Of crucial importance in implementing riparian habitat restoration projects will be determining a compensation formula to provide landowners with an incentive to implement this type of project.

10.4.2 Project RIP-2: Restoration of the Rock Quarry

As shown in Figure 7-13B, the rock quarry is a 0.75 mile stretch of the upper watershed that is lacking an intact riparian corridor. This area was observed to contain almost no riparian habitat. It is characterized by large boulders, steep cascades, and bedrock chutes. Restoration of the riparian habitat in this area would restore a long stretch of stream length. However, it should be noted that due to access issues, restoration of this area would be difficult and time consuming.

10.5 WATER QUALITY IMPROVEMENT PROGRAM

10.5.1 Project WQ-1: Increased Agency Coordination

During preparation of this plan, it was noted that several agencies are conducting ongoing monitoring efforts within the lower Rincon Creek watershed. These agencies include:

- Santa Barbara County
- Ventura County
- LTER
- RWQCB
- Heal the Bay

Each agency implements its own water quality sampling methods and provides an independent analysis of their results. It is recommended that these agencies begin collaborating to share data and better determine a comprehensive, watershed-based approach to water quality sampling. This collaboration could be aided by the existence of the RCWC, if representatives from each agency regularly attended the meetings. Increased collaboration would also result in decreased sampling costs, if repetitive sampling and analysis were eliminated.

10.5.2 Project WQ-2: Volunteer Water Quality Monitoring Program

It is recommended that a watershed-wide volunteer water quality sampling program be developed. Currently, there is no agency-conducted water quality sampling within the upper watershed (Figure 5-1).

Given the frequency of water quality sampling within the lower watershed, water quality sampling in the upper watershed would provide a comprehensive picture of water quality within the watershed. The goal of the volunteer water quality sampling program could include development of a comprehensive, watershed-wide dataset covering several years.

Some landowners within the upper watershed conduct yearly water quality sampling, since the creek is used for drinking water. One landowner has expressed an interest in having the water quality tested in the upper watershed and a willingness to allow access to do so. Several additional landowners have expressed an interest in participating in a volunteer water quality monitoring program.

Coordination with the Forest Service is recommended in order to complete water quality sampling within the upper watershed. The Forest Service has indicated that there is a grazing allotment in the watershed; however, it has been vacant for at least the past 15 to 20 years (Webb 2007). If an application to use this allotment was submitted, the Forest Service would evaluate the potential environmental impacts, including downstream water quality impacts, before allowing grazing (Webb 2007).

10.5.3 Project WQ-3: BMI Sampling

Benthic macroinvertebrates (BMI) are insects that are visible to the naked eye and live within streambeds and substrates. Measurement of the abundance and diversity of BMIs can be used to monitor stream and water quality. Data from other local streams can be used as reference samples, to better evaluate the health of the stream sampled. Different BMIs exist within stream habitats like riffles, runs, and pools. BMIs are also a food source for fish and other organisms.

The use of BMI sampling to determine the health and integrity of aquatic ecosystems is well-accepted. For example, the Environmental Protection Agency (EPA) recognizes the use of BMI monitoring as a method to determine the biological integrity of aquatic systems under the Clean Water Act. The California Bioassessment Procedure (CSBP) is a method that can be applied in Rincon Creek. The CSBP is a cost-effective tool that utilizes measures of the BMI community and the physical/habitat characteristics to determine the biological and physical integrity of the stream (CDFG 2003). Representatives from the CDFG would likely be willing to provide training in the CSBP method. Implementation of the CSBP within Rincon Creek is recommended.

10.6 ENHANCEMENT OF WILDLIFE HABITAT AND MIGRATION

10.6.1 Project WILD-1: Remediation of the Highway 101 Culvert

As described in Section 7.0, Caltrans is working on a design to alter the Highway 101 culvert inlet to allow for fish passage. Removal of this barrier would allow steelhead to access up to the next upstream barrier within Rincon Creek, which is a privately owned barrier (Figure 7-11, Barrier R_2). This stretch of Rincon Creek represents 4,050 meters of steelhead habitat that was determined to be fair and good habitat for adult steelhead. A small stretch of very good habitat for adult steelhead also occurs in this area (just downstream of R_2).

Alteration of the Highway 101 culvert would also allow steelhead access to the first upstream barrier within Casitas Creek, which occurs 879 meters above the confluence with Rincon Creek. Habitat within this reach is rated as good, although severe sedimentation issues occur within Casitas Creek.

Prior to remediation of the Highway 101 culvert, a study assessing the changes to the downstream hydrology should be performed. Landowners have indicated that there are wave refraction issues downstream of the culvert at times, and that any change to the Highway 101 culvert should address these issues. In addition, several landowners have indicated that debris (for example, large eucalyptus trees) can catch in the upstream entrance to the Highway 101 culvert during high flows. Prior to any change to the Highway 101 culvert, a debris flow study should be performed.

After the upstream apron is removed, Caltrans will perform monitoring to determine if steelhead are able to migrate through the culvert into upstream habitats.

10.6.2 Project WILD-2: Removal of Rincon Creek Steelhead Upstream Migration Barriers

Upstream of the Highway 101 culvert within the mainstem of Rincon Creek are several steelhead upstream migration barriers. Removal of these barriers should be planned from a downstream to upstream approach. From R_2 up to the rock quarry (R_11), approximately 2,500 meters of adult steelhead habitat exists. This habitat was rated as very good and good for adult steelhead. This area was also characterized by clear water with very low sedimentation. Many of the barriers within this area are road crossings. Conceptual approaches to removal of these road crossings are shown in Figure 10-5.

A conceptual approach to improve fish passage at a road crossing would involve creating a step-pool structure to reduce vertical drop and slow flows across the barrier. Bank stability and hydraulic heterogeneity at the flanks of the structure can be improved by placing riprap. The width of the roughness elements should be scaled to maintain passable depths and velocities. If the structure is removed, the installation of several sequential smaller grade control structures should be considered since this structure would stabilize the reach from downstream incision.

An issue associated with barrier removal projects is the tax impacts for the landowner. Within Santa Barbara County, the normal procedure is that the Tax Assessor's Office is contacted when a construction permit is processed by the Planning and Development department. The new construction is assessed and a determination is made on whether the property value has increased. Property may not increase in value even if a new bridge is built. The change in value is assessed on a case-by-case basis. There are no special exemptions for projects that restore habitat or assist an endangered species. However, a landowner can contact the Assessor's office prior to submitting a permit application. Special circumstances can be taken under consideration during the assessment (Constantine 2007). A similar process would likely be used to assess any change in property taxes for landowners within Ventura County.

10.6.3 Project WILD-3: Removal of Casitas Creek Steelhead Upstream Migration Barriers

Casitas Creek also contains several steelhead upstream migration barriers. Removal of these barriers should be planned from a downstream to upstream approach. From C_1 up to C_5, approximately 1,132 meters of adult steelhead habitat exists. This habitat was rated as fair and good for adult steelhead, with small areas of poor habitat also occurring. It is also important to note that the entire length of Casitas Creek had highly turbid water (201-350 NTUs), which severely degrades steelhead habitat. There is also a lack of pool habitat in Casitas Creek. Many of the barriers are road crossings. Conceptual approaches to removal of road crossings that were described for Rincon Creek could also be applied to Casitas Creek.

10.6.4 Project WILD-4: Wildlife Migration Study

Wildlife migration within the Rincon Creek watershed has not been previously studied, with the exception of steelhead. The watershed has a large expanse of open space, including national forest land,

and likely supports a wide variety of wildlife species. Rincon Creek is likely used as a migration corridor, with species using the creekbed to traverse the area. This is supported by field observations, which observed many wildlife sign (tracks, scat) within the creek. Landowners have also indicated the presence of many species in the area.

The presence of Highway 150 and additional surface roads likely represent barriers to wildlife migration. The first step in analyzing wildlife movement within the area is to implement a voluntary roadkill monitoring program. This program can be implemented by recruiting local landowners to document roadkill occurring in the watershed, which can be done through the RCWC. A roadkill data form could be posted to the website. One challenge will be identifying a data keeper that will collect and maintain the roadkill data.

Once roadkill data is obtained, it can be used to identify key points that wildlife are attempting to migrate and used to design wildlife crossing structures and other solutions (reduced speed limits, signage).

10.6.5 Project WILD-5: Steelhead Monitoring Project

Annual monitoring of steelhead occurrence within the watershed is recommended. This project will provide baseline data on the current status of steelhead in the watershed and will also provide data once the Highway 101 culvert has been remediated. A Steelhead Monitoring Plan should be developed in order to ensure that monitoring activities are conducted in a reproducible manner. Of particular interest is the numbers of steelhead that are able to migrate to the upstream apron of the Highway 101 culvert in its current condition.

10.6.6 Project WILD-6: Spring/seep Analysis

A study is recommended to determine where springs and seeps are located in the watershed. This data can be used to determine where cool water locations that fish may favor. A recent study was also done in Topanga Creek and the results indicate that fish may favor cool water areas fed by springs and seeps (Larson 2007). Spring and seep data may also provide useful information for other issue areas, like areas that Cape ivy may also favor due to the presence of water.

10.7 ADDITIONAL PROJECTS

10.7.1 Project AGREE-1: Safe Harbor Agreement

In discussions with landowners regarding the return of steelhead to the watershed, a concern regarding the landowner restrictions once a listed species is present were repeatedly raised. To address this issue, the U.S. Fish and Wildlife Service and NOAA Fisheries have developed Safe Harbor Agreements. These agreements effectively protect a landowner from land restrictions if they restore habitat for an endangered species and the endangered species returns. The goal of Safe Harbor Agreements is to promote voluntary management for listed species on non-Federal property. Any non-Federal landowner can request the development of a Safe Harbor Agreement.

Development of a Safe Harbor Agreement with NOAA Fisheries is recommended. Currently, there is no proposed or accepted Safe Harbor Agreement for steelhead within California (Crump 2007). Preliminary discussions with NOAA Fisheries have indicated that the agency would prefer to protect rearing habitat for the species, as opposed to protecting an entire watershed (Crump 2007). Key steps in the development of an agreement are to: develop a baseline estimate of steelhead presence within the watershed, identify areas within the creek that contain important steelhead rearing habitat, identify the owners of these areas and approach them regarding participation in the process, and discuss with NOAA

Fisheries the possibility of having several landowners work together to develop a Safe Harbor Agreement that includes multiple properties.

As efforts to allow steelhead passage through the Highway 101 culvert progress, a Safe Harbor Agreement will become increasingly important. An important aspect of Safe Harbor Agreements is the development of a baseline condition for the species, which should be developed prior to the remediation of the Highway 101 culvert. Additional information regarding Safe Harbor Agreements is provided within Section 12.

10.7.2 Project POINT-1: Rincon Point Access Road Protection Study

Residents within the Rincon Point community have expressed concern over the continual erosion of their access road. This area was historically a small lagoon that was filled in over time to accommodate for development. The access road will eventually be jeopardized by the erosion and a solution is needed. It is recommended that an engineering study be conducted to determine an appropriate design solution. The proposed solution must evaluate the environmental impacts and develop a solution that protects the road while minimizing these impacts. Permits from the appropriate agencies, such as the USACE, CDFG, and RWQCB, will be required prior to implementation of a project at this location.

11.0 IMPLEMENTATION PLAN

Twenty four projects were identified within Section 10.0 and are listed in Table 11-1.

Table 11-1: Recommended Projects

Code	Project Title
SED-1	Toe Stabilization of Large Erosional Features
SED-2	Biotechnical Stabilization of Medium Eroded or Unstable Banks
SED-3	Creation of Floodplain Inset Bench
SED-4	Bed Stabilization of Tributaries
SED-5	Implementation of Best Management Practices
SED-6	Roadway Sediment Source Assessment
SED-7	Increased Education Regarding Sediment Control Methods
WEED-1	Vegetation Management Plan
WEED-2	Giant Reed Eradication
WEED-3	Ivy and Nasturtium Eradication
WEED-4	Education Program
RIP-1	Restoration of Riparian Habitat
RIP-2	Rock Quarry Restoration
WQ-1	Increased Agency Coordination
WQ-2	Volunteer Water Quality Monitoring Program
WQ-3	BMI Sampling
WILD-1	Remediation of the Highway 101 Culvert
WILD-2	Removal of Rincon Creek Steelhead Upstream Migration Barriers
WILD-3	Removal of Casitas Creek Steelhead Upstream Migration Barriers
WILD-4	Wildlife Migration Study
WILD-5	Steelhead Monitoring Project
WILD-6	Spring/seep Analysis
AGREE-1	Safe Harbor Agreement
POINT-1	Rincon Point Access Road Protection Study

This section further evaluates those projects in terms of technical benefits and feasibility factors. Only those projects that represent on the ground efforts are scored on technical and feasibility factors.

11.1 IMPLEMENATION PLAN MATRIX

11.1.1 Technical Evaluation

Each on the ground project was evaluated technically in terms of the projects impacts on the key issues within the watershed. A technical score was applied for each issue area. The technical scores were developed based on the estimated magnitude and scale of impact. A technical score of zero was applied if the project would have no impact on the key issue, a score of 1 was used if the project would have a minor impact, a score of 2 was used if the project would have a large impact at a local-scale or a medium impact at a watershed-scale, and a score of 3 was applied if the project would have a large impact at a watershed-scale. The results of this technical evaluation are provided in Table 11-2.

Table 11-2: Technical Evaluation

Key Issue	SED-1	SED-2	SED-3	SED-4	SED-5	WEED-2	WEED-3	RIP-1	RIP-2	WILD-1	WILD-2	WILD-3
Non-natives	0	0	0	0	0	3	3	0	0	0	1	1
Sediment	3	2	3	2	3	1	1	3	1	1	0	0
Steelhead Habitat	3	3	2	2	2	0	1	1	2	3	2	1
Riparian Corridor	2	2	2	0	0	2	2	3	2	1	1	1
Technical Score	**8**	**7**	**7**	**4**	**5**	**6**	**7**	**7**	**5**	**5**	**4**	**3**

Scoring: 0=No impact; 1=Minor impact; 2=Large impact at a local scale or medium impact on a watershed-scale; 3=Large impact at watershed-scale.

In order to illustrate how the technical scores in Table 11-2 were developed, the assumptions used to score several projects are described below.

SED-1: Toe Stabilization of Large Erosional Features

The scores applied assumed that several of the large erosional features would be remediated, thus resulting in a large impact at a watershed-scale, or a technical score of 3 for sediment. This would also result in improved habitat for steelhead at a watershed-scale, which results in a steelhead habitat score of 3. Improvements in riparian habitat would also result from this project, since it is anticipated that habitat restoration efforts would be implemented. The improvement in riparian habitat would occur at the locations that were remediated, resulting in a riparian corridor score of 2. Therefore, the overall technical score for this project is 8.

SED-2: Biotechnical Stabilization of Medium Eroded or Unstable Banks

The scores applied assumed that several of locations with medium eroded or unstable banks would be remediated, thus resulting in a large impact at the local locations, or a technical score of 2 for sediment. Remediation of several locations of medium eroded or unstable banks would result in improved habitat for steelhead at a watershed-scale, which results in a steelhead habitat score of 3. Improvements in riparian habitat would also result from this project, since it is anticipated that habitat restoration efforts would be implemented. The improved in riparian habitat would occur at the locations that were remediated, resulting in a riparian corridor score of 2. Therefore, the overall technical score for this project is 7.

SED-3: Creation of Floodplain Inset Bench

The scores applied assumed that a floodplain bench would be created within a long stretch of Rincon Creek or Casitas Creek. Under either scenario, a large impact on sedimentation at a watershed-scale would occur, resulting in a technical score of 3. A floodplain bench would improve steelhead habitat would have a medium impact on steelhead habitat at a watershed-scale, which results in a steelhead habitat score of 2. Riparian habitat would also be largely improved at the locations restored, resulting in a riparian corridor score of 2. Therefore, the overall technical score for this project is 7.

The results of the technical evaluation indicate which projects in each issue area would have the greatest impact. Table 11-3 lists the projects within each issue area from highest to lowest technical score.

Table 11-3: Technical Evaluation Rankings within each Issue Area

Code	Project Title	Technical Score
SED-1	Toe Stabilization of Large Erosional Features	8
SED-2	Biotechnical Stabilization of Medium Eroded or Unstable Banks	7
SED-3	Creation of Floodplain Inset Bench	7
SED-5	Implementation of Best Management Practices	5
SED-4	Bed Stabilization of Tributaries	4
WEED-3	Ivy and Nasturtium Eradication	7
WEED-2	Giant Reed Eradication	6
RIP-1	Restoration of Riparian Habitat	7
RIP-2	Rock Quarry Restoration	5
WILD-1	Remediation of the Highway 101 Culvert	5
WILD-2	Removal of Rincon Creek Steelhead Upstream Migration Barriers	4
WILD-3	Removal of Casitas Creek Steelhead Upstream Migration Barriers	3

As shown in Table 11-3, toe stabilization of large erosional features (SED-1) would have the largest impact on the sedimentation issues in the watershed; removal of ivy and nasturtium (WEED-3) would have the largest impact on non-native, invasive plant species; and restoration of riparian habitat (RIP-1) would have the greatest impact on the riparian corridor. Remediation of the Highway 101 culvert (WILD-1) would have the greatest impact on steelhead habitat, since this barrier effectively blocks access to the watershed.

11.1.2 Feasibility Evaluation of Projects

A feasibility analysis was performed. Each project was given a score of 3, 2, or 1 for funding, time, and owner willingness, as shown in Table 11-4. These scores were then added to determine a feasibility score for each project, as shown in Table 11-5. In January 2007, the CEC and Tetra Tech conducted interviews with several landowners within the watershed. These interviews provided information about many of the ongoing land use practices and assisted in determining the owner willingness scores that were used in the feasibility analysis.

Table 11-4: Feasibility Scoring

Score	Cost ($)	Time (years)	Willing Owner
3	0 – 25,000	0 – 2	Yes
2	25,000 – 50,000	2 – 5	Unknown
1	>50,000	>5	No

Table 11-5: Feasibility Evaluation

Factors	SED-1	SED-2	SED-3	SED-4	SED-5	WEED-2	WEED-3	RIP-1	RIP-2	WILD-1	WILD-2	WILD-3
Cost	1	2	1	1	3	3	1	2	1	1	2	2
Time	1	2	2	1	3	2	1	2	1	2	2	2
Owner Willing	2	2	2	2	3	3	2	2	2	3	3	2
Feasibility Score	**4**	**6**	**5**	**4**	**9**	**8**	**4**	**6**	**4**	**6**	**7**	**6**

The feasibility scores were developed based on the information available at the time the watershed plan was prepared. They have been used to develop broad-scale watershed planning recommendations. These feasibility scores have not included detailed geotechnical evaluations or other studies that would be required to determine if recommended projects are feasible at specific locations. For example, although the development of a floodplain inset bench is recommended, additional geotechnical evaluations to determine appropriate locations are needed.

11.1.3 Overall Priority List of Projects

The results of the technical and feasibility evaluations were added to determine a combined score for each project, as shown in Table 11-6.

Table 11-6: Combined Score

	SED-1	SED-2	SED-3	SED-4	SED-5	WEED-2	WEED-3	RIP-1	RIP-2	WILD-1	WILD-2	WILD-3
Technical Score	8	7	7	4	5	6	7	7	5	5	4	3
Feasibility Score	4	6	5	4	9	8	4	6	4	6	7	6
Combined Score	**12**	**13**	**12**	**8**	**14**	**14**	**11**	**13**	**9**	**11**	**11**	**9**

The combined score was used to determine which projects are high, medium, and low priorities as shown in Table 11-7. It should also be noted that although projects without an on the ground component were not included in the technical and feasibilities analyses, their benefit to the watershed should not be underestimated and they have been included.

Table 11-7: Prioritized List of Projects

Code	Project Title	Priority
SED-5	Implementation of Best Management Practices	High
WEED-2	Giant Reed Eradication	High
SED-2	Biotechnical Stabilization of Medium Eroded or Unstable Banks	High
RIP-1	Restoration of Riparian Habitat	High
SED-1	Toe Stabilization of Large Erosional Features	High
SED-3	Creation of Floodplain Inset Bench	High
WILD-1	Remediation of the Highway 101 Culvert	Medium
WILD-2	Removal of Rincon Creek Steelhead Upstream Migration Barriers	Medium
WEED-3	Ivy and Nasturtium Eradication	Medium
RIP-2	Rock Quarry Restoration	Low
WILD-3	Removal of Casitas Creek Steelhead Upstream Migration Barriers	Low
SED-4	Bed Stabilization of Tributaries	Low
SED-6	Roadway Sediment Source Assessment	-
SED-7	Increased Education Regarding Sediment Control Methods	-
WEED-1	Vegetation Management Plan	-
WEED-4	Education Program	-
WQ-1	Increased Agency Coordination	-
WQ-2	Volunteer Water Quality Monitoring Program	-
WQ-3	BMI Sampling	-
WILD-4	Wildlife Migration Study	-
WILD-5	Steelhead Monitoring Study	-
WILD-6	Spring/seep Analysis	-
AGREE-1	Safe Harbor Agreement	-
POINT-1	Rincon Point Access Road Protection Study	-

Potential locations where high priority projects should be considered are shown in Figures 11-1A and 11-1B. These locations are provided as a general guide, more detailed geotechnical evaluations and other studies will be needed before implementing many of the projects. Project SED-5 should be implemented throughout the watershed, therefore, it is not included within Figures 11-1A and 11-1B. Restoration of the riparian corridor (Project RIP-1) is a recommendation for the entire length of Casitas Creek. Specific locations where there is a lack of a riparian corridor have been mapped and are shown in Figures 11-1A and 11-1B. Under the ideal condition, both creeks would contain a 50 to 100 foot buffer between the creek and anthropogenic activities. Locations shown in Figures 11-1A and 11-1B are intended as a starting point towards reaching the ideal condition. Project SED-3 could be implemented at many locations within Rincon and Casitas Creeks, although only one potential location is shown in Figures 11-1A and 11-1B.

11.2 IMPLEMENTATION STRATEGY

For the six projects given the highest priority, key steps to implementation have been determined. Each project is described below.

11.2.1 SED-5: Implementation of Best Management Practices

Under the Ag Waiver program, growers are required to implement BMPs. Given that an existing program is already in place, the implementation strategy is to communicate the BMPs recommended based off the geomorphic analysis conducted to the Ag Waiver coordinator to determine the ideal way to implement these BMPs. The NRCS and Cachuma RCD can also provide technical input on the development and implementation of BMPs. Information regarding implementation of this project is provided below.

Next Steps

- Willing agency to contact the Agricultural Watershed Coalition.

Alternative Approach

- Willing landowner to contact the NRCS or Cachuma RCD for assistance in the development and implementation of BMPs.

Target Dates

- Begin program in fall 2007.

Maintenance and Monitoring

- Annual monitoring to determine if BMPs recommended in this plan are implemented is recommended.

Potential Funding Sources

- EPA Nonpoint Source Implementation Grants (319 Program).
- NRCS Environmental Quality Incentives Program (EQIP).
- Western Sustainable Agricultural Research & Education (SARE) program grants.

11.2.2 WEED-1: Giant Reed Eradication

The first recommended implementation strategy is to approach Tom Dudley or another researcher regarding the potential use of the watershed for a giant reed biocontrol removal project site. Agencies that could assist in implementing this measure include the CEC and Santa Barbara County. If biocontrol proves too time consuming, then traditional methods may be used. The Santa Barbara County Agricultural Commissioner's Weed Management Area (WMA) has undertaken a watershed-scale removal effort of giant reed in other watersheds, like Carpinteria Creek. An organic avocado grower with a small patch of giant reed within her property has expressed a willingness to participate in an eradication program. Information regarding implementation of this project is provided below.

Next Steps

- Willing landowner to contact Tom Dudley or other researcher regarding biocontrol program.

Alternative Approach

- Willing landowner to contact the Santa Barbara County Agricultural Commissioner's WMA. A memorandum of agreement may be necessary in order for the Santa Barbara County WMA to have jurisdiction over the entire watershed.

Target Dates

- Begin program in fall 2007.

Maintenance and Monitoring

- Annual maintenance and monitoring will be required for several years to prevent reestablishment. Carpinteria Creek has monitoring planned for 10 years.

Potential Funding Sources

- California Department of Food and Agriculture.
- Center for Invasive Plant Management.
- CDFG Adaptive Watershed Improvement Program.
- USFWS Private Stewardship Grant Program.
- National Fish and Wildlife Foundation Grants.
- Wetlands Recovery Project Grants.
- Wildlife Conservation Board Grant Program.

11.2.3 SED-2: Biotechnical Stabilization of Medium Eroded or Unstable Banks

The recommended implementation strategy is to approach landowners with medium eroded or unstable banks. Agencies that could assist in implementing this measure include the CEC, the Cachuma RCD, the NRCS, and the Agricultural Watershed Coalition. Information regarding implementation of this project is provided below.

Next Steps

- Willing agency to approach landowners.

Additional Studies

- Depending on sites selected, additional site investigations and analysis (site surveys, geotechnical investigations, hydraulic conditions study, and shear stress studies) will be needed.

Target Dates

- Begin approaching landowners in fall 2007.
- Implementation of restoration methods targeted for fall 2008.

Maintenance and Monitoring

- Biotechnical stabilization projects are typically accompanied by habitat restoration that requires 3-5 years of maintenance and monitoring.
- Monitoring of the reduction in sedimentation generated by the project should also be conducted.

Potential Funding Sources

- CDFG Fisheries Restoration Grant.
- USFWS Coastal Program.
- NRCS EQIP.
- EPA Nonpoint Source Implementation Grants (319 Program).

11.2.4 RIP-1: Restoration of Riparian Habitat

The recommended implementation strategy is to approach landowners with long stretches of stream that lack a riparian corridor. Agencies that could assist in implementing this measure include the CEC, the Cachuma RCD, the NRCS, and the Agricultural Watershed Coalition. Information regarding implementation of this project is provided below.

Next Steps

- Willing agency to approach landowners.

Alternative Approach

- Given the recent winds and freezing conditions that have damaged avocado trees within the watershed (January 2007), landowners may be removing avocado trees in 2007. Educating landowners about the potential benefits of creating a buffer between the creeks and anthropogenic activities may encourage them not to replace avocado trees within the riparian corridor. During 2007, landowners should be approached regarding creation of a buffer zone and potential funding sources and strategies to compensate them.

Additional Studies

- Depending on sites selected, additional site investigations and analysis (site surveys, geotechnical investigations, hydraulic conditions study, and shear stress studies) will be needed.

Target Dates

- Begin approaching landowners in fall 2007.
- Implementation of restoration efforts 2008-2010.

Maintenance and Monitoring

- Habitat restoration elements will require 3-5 years of maintenance and monitoring.

Potential Funding Sources

- CDFG Fisheries Restoration Grant.
- USFWS Coastal Program.
- NRCS EQIP.
- USFWS Private Stewardship Grants Program.
- NRCS WHIP.
- Wetlands Recovery Project Small Grants Program.
- Center for Invasive Plant Management.
- CDFG Adaptive Watershed Improvement Program.
- USFWS Private Stewardship Grant Program.
- National Fish and Wildlife Foundation Grants.
- Wildlife Conservation Board Grant Program.

11.2.5 SED-1: Toe Stabilization of Large Erosional Features

The recommended implementation strategy is to approach landowners with large erosional features. Agencies that could assist in implementing this measure include the CEC, the Cachuma RCD, the NRCS, and the Agricultural Watershed Coalition. Information regarding implementation of this project is provided below.

Next Steps

- Willing agency to approach landowners.

Additional Studies

- Depending on sites selected, additional site investigations and analysis (site surveys, geotechnical investigations, hydraulic conditions study, and shear stress studies) will be needed.

Target Dates

- Begin approaching landowners in fall 2007.
- Implementation of restoration methods targeted for 2008-2010.

Maintenance and Monitoring

- Projects are typically accompanied by habitat restoration that requires 3-5 years of maintenance and monitoring.
- Monitoring of the reduction in sedimentation generated by the project should also be conducted.

Potential Funding Sources

- CDFG Fisheries Restoration Grant.
- USFWS Coastal Program.
- NRCS EQIP.
- EPA Nonpoint Source Implementation Grants (319 Program).

11.2.6 SED-3: Creation of Floodplain Inset Bench

This project could be implemented at several locations within Rincon and Casitas Creek. One location that was obvious during the field survey is mapped in Figure 11-1A. A suggested implementation strategy is to approach landowners within Rincon Creek and Casitas Creek regarding the installation of a floodplain inset bench. Agencies that could assist in implementing this measure include the CEC, the Cachuma Resources Conservation District, and the Agricultural Watershed Coalition. Information regarding implementation of this project is provided below.

Next Steps

- Willing agency to approach landowners.

Additional Studies

- Depending on sites selected, additional site investigations and analysis (site surveys, geotechnical investigations, hydraulic conditions study, and shear stress studies) will be needed.

Target Dates

- Begin approaching landowners in fall 2007.
- Implementation targeted for 2008-2010.

Maintenance and Monitoring

- Projects are typically accompanied by habitat restoration that requires 3-5 years of maintenance and monitoring.
- Monitoring of the reduction in sedimentation generated by the project should also be conducted.

Potential Funding Sources

- CDFG Fisheries Restoration Grant.
- USFWS Coastal Program.
- NRCS EQIP.
- USFWS Private Stewardship Grants Program.
- NRCS WHIP.
- Wetlands Recovery Project Small Grants Program.
- Center for Invasive Plant Management.
- CDFG Adaptive Watershed Improvement Program.
- USFWS Private Stewardship Grant Program.
- National Fish and Wildlife Foundation Grants.
- Wildlife Conservation Board Grant Program.

11.3 WATERSHED PLAN SUCCESS CRITERIA

It is recommended that the projects outlined in this section been evaluated annually beginning in the fall of 2007 by the RCWC. Table 11-8 provides sample questions that can be used to annually evaluate each recommended project. The annual evaluation of the watershed plan should also include the addition of new projects.

Table 11-8: Annual Evaluation

Status Questions	Action Needed
Projects in the planning stages	
Have the next steps been taken?	-
Has funding for the project been pursued and received?	-
Are additional studies needed?	-
Have new project challenges arisen?	-
Have the key issues addressed by the project substantially changed, thus requiring an updated assessment?	-
Projects that have been implemented	
Are ongoing monitoring and maintenance activities being implemented and are they sufficient?	-
Have improvements in the key issue areas occurred?	-
Do monitoring results indicate lessons that can be applied to similar projects within the watershed?	-

11.4 PROCESS FOR UPDATING THE WATERSHED PLAN

As projects are planned, implemented, and evaluated, the baseline condition of the watershed will change. It is recommended that the RCWC annually evaluate the condition of the watershed, especially regarding the key issues identified in the plan, and provide updated information to landowners through the use of the website, monthly meetings, and the newsletter.

12.0 LANDOWNER INCENTIVES

12.1 SAFE HARBOR AGREEMENTS

The U.S. Fish and Wildlife Service and NOAA Fisheries have developed Safe Harbor Agreements as a method of providing landowners within an incentive to restore habitat for threatened and endangered species within their land. These agreements effectively protect a landowner from land restrictions if they restore habitat for an endangered species and the endangered species returns. The goal of Safe Harbor Agreements is to promote voluntary management for listed species on non-Federal property. Any non-Federal landowner can request the development of a Safe Harbor Agreement. As remediation of the Highway 101 culvert progresses, landowners within the watershed may want to pursue a Safe Harbor Agreement with NOAA Fisheries.

12.2 CONSERVATION EASEMENTS

Conservation easements are a legal agreement between a landowner and a private organization or government agency that permanently limits the uses of the land in order preserve its conservation values. Conservation easements protect the land for future generations while also allowing owners to retain private property lines and continue to use their land, and the same time potentially providing tax benefits. Conservation easements can be sold or donated, and the landowner gives up some of the rights associated with the land (for example, the right to subdivide or develop), while retaining other rights (for example, the right to continue agricultural production).

Conservation easements are designed based on the values of the property. For example, easements with important wildlife habitat may prohibit future development. Easements can apply to a portion of the property or all of the property. The private organization or government agency is responsible for ensuring that the terms of the conservation easement are followed. In many cases, landowners gain tax incentives for placing a portion of their property under a conservation easement.

In Ventura County, a local Subdivision Ordinance has been adopted, which allows for property to be split below the legal zoning to create a conservation parcel that can be sold to an approved conservation entity.

12.3 LAND CONSERVATION ACT

The Ventura County Land Conservation Act (LCA) is a state-adoped, voluntary, land conservation program that is also known as the "Williamson Act". The purposes of the LCA Program are to preserve the limited and diminishing supply of agricultural land in the County; to preserve and promote commercial agricultural industry; to encourage the production of food, fiber, and ornamental crops and commodities; and to discourage premature conversion of agricultural land to nonagricultural uses.

The Ventura County LCA guidelines were adopted July 25, 2006. The LCA guidelines provide tax incentives to landowners in return for protecting agricultural and open space land. The LCA guidelines "also assists local governments in protecting non-agricultural open space when the affected property qualify as a scenic highways corridor, a wildlife habitat area, a saltpond, a managed wetland area, or a submerged area."

Given the large percentage of the Rincon Creek watershed that is within agricultural use, the LCA guidelines provide potential benefits to agricultural landowners. However, the issue is complicated by the fact that the watershed lies along the boundary of Ventura and Santa Barbara Counties. Landowners clearly within the Ventura County jurisdiction could benefit from the LCA guidelines.

12.4 NRCS CONSERVATION PROGRAMS

The NRCS provides conservation planning and technical assistance to individuals, groups, and units of government. The NRCS assists these clients in the development and implementation of conservation plans to protect, conserve, and enhance natural resources. The approach used by the NRCS is to integrate natural resource, economic, and social considerations to meet private and public needs. NRCS conservation programs are voluntary and confidential. The goal in NRCS conservation planning is the sound use and management of soil, water, air, plant, and animal resources to prevent their degradation and ensure their sustained use and productivity while also considering related human social and economic needs (NRCS 2007). The NRCS is a valuable resource for landowners requiring technical input into the management of their land.

13.0 REFERENCES

Bancroft Library

2007a Cerro del Rincon: Santa Barbara and Ventura Counties, CA. 1855. Contributing Institution: The Bancroft Library, University of California, Berkeley, CA. Available for download at http://content.cdlib.org/ark:/13030/hb300004nq/

2007b Diseño: Rancho El Rincon, Santa Barbara and Ventura Counties, CA. 1840's. Contributing institution: The Bancroft Library, University of California, Berkeley, CA. Available for download at http://content.cdlib.org/ark:/13030/hb100002x8/

Cachuma Resource Conservation District (RCD) and the Carpinteria Creek Watershed Coalition

2005 Carpinteria Creek Watershed Plan. Prepared for the California Department of Fish and Game. Available for download at http://carpinteriacreek.org/documents.htm.

California Department of Fish and Game (CDFG)

1943 Rincon Creek. Fish Planting Field Record. Receipt from the Fillmore Hatchery (receipt number 43). 1,500 rainbow trout planted April 30, 1943. Document provided by the Center for the Ecosystem Management and Restoration (CEMAR) under the Southern Steelhead Resources Project.

1944a Rincon Creek. Fish Planting Field Record. Receipt from the Fillmore Hatchery (receipt number 24). 900 rainbow trout planted March 31, 1944. Document provided by the U.S. Forest Service.

1944b Fish Rescue and Planting Record. 2,272 ounces (with an estimated 10 fish to the ounce) or 22,720 total steelhead fry rescued from the Santa Ynez River and planted in Rincon Creek. Santa Ynez Rescue No. 34. August 4, 1944. Document provided by the U.S. Forest Service.

1947 Fish Planting Receipt from the Fillmore Hatchery (receipt number 45). 500 rainbow trout planted March 28, 1947. Document provided by the U.S. Forest Service.

1956 Interoffice Correspondence from B.H. Unruh to the CDFG Fisheries Management – Region 5. Subject: Quarry Operations (Pollution) Recommendations. August 30, 1956.

2003 California Department of Fish and Game Water Pollution Control Laboratory. Aquatic Bioassessment Laboratory. California Stream Bioassessment Procedure. December 2003.

California Spatial Library

1996 Available online at http://gis.ca.gov/.

California State Archives

2007 California Department of Public Works, Division of Highways-District VII. Available for download at http://www.ss.ca.gov/archives/level3_phguideimg10.html.

Cardenas, M.

1999 Letter to Tim Smith, U.S. Army Corps of Engineers from California Department of Fish and Game.

Castelle, A. J., and A. W. Johnson.
2000 Riparian vegetation effectiveness. National Council for Air and Stream Improvement Technical Bulletin No. 799. 26 p.

Cesena, C.
1994 Letter to Dennis McEwan (CDFG) regarding the history of the Highway 101 culvert. Dated September 6, 1994.

2006 Personal communication between Chuck Cesena (Caltrans) and Michelle Bates (Tetra Tech, Inc.) regarding past Caltrans activities within Rincon Creek.

2007 Personal communication between Chuck Cesena (Caltrans) and Michelle Bates (Tetra Tech, Inc.) regarding current plans for remediation of the Highway 101 culvert.

City of Carpinteria
2007 Carpinteria Housing Element.
http://www.carpinteria.ca.us/PDFs/cd_Housing%20Element.pdf.

Constantine, C.
2007 Personal communication between Candice Constantine (Santa Barbara County) and the Santa Barbara County Tax Assessor's Office. May 2007.

Crump, K.
2007 Personal communication between Kit Crump (NOAA Fisheries) and Michelle Bates (Tetra Tech, Inc.) regarding Safe Harbor Agreements. March 2007.

Dagit, R., Reagan, K., and C. Swift
2003 *Topanga Creek Watershed Southern Steelhead Trout: Preliminary Watershed Assessment and Restoration Plan Report.* Prepared for California Department of Fish and Game, March 2003. Resource Conservation District of the Santa Monica Mountains, Topanga, CA.

2004 *Topanga Creek Southern Steelhead Trout Monitoring Report*. Prepared for Pacific States Marine Fisheries Commission and California Department of Fish and Game, March 2004. Resource Conservation District of the Santa Monica Mountains, Topanga, CA.

Dudley, T.
2006 Biological Approaches for Controlling Invasive Riparian Plants: Giant Reed (*Arundo donax*) & Tamarisk. Powerpoint presentation given in 2006 to the Rincon Creek Watershed Council. Co-Operators: Alan Kirk & Tom Widmer, USDA-ARS, Montpellier, France & Saltcedar Consortium: Jack DeLoach (USDA-ARS), Dan Bean (UC Davis), Dave Thompson (NMSU). Available for download at www.rinconcreek.org.

2007 Biological Control of Invasive Riparian Plants: Giant Reed and Cape Ivy. Presentation to the RCWC on April 25, 2007.

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and B. Collins
1998 *California Salmonid Stream Restoration Manual.* State of California, The Resources Agency, California Department of Fish and Game, Inland Fisheries Division, Third Edition. Amended 2005.

Fulton, W., Wilson, J., Ryan, C., Kancler, E., and A. Harrison

2003 *Recent Growth Trends and Future Growth Policy Choices For Ventura County.* A joint publication of Southern California Studies Center, University of Southern California and Solimar Research Group. December.

Heal the Bay

2005 Fish Migration Barrier Severity and Steelhead Habitat Quality in the Malibu Creek Watershed. Analysis conducted by Mark Abramson and Mike Grimmer. Heal the Bay, Santa Monica, CA.

Johannesson, H. and G. Parker

1985 Computer Simulated migration of meandering rivers in Minnesota. Report for the Minnesota Department of Transportation. Minneapolis, Minnesota.

Kelsey, H.

1986 *Juan Rodriguez Cabrillo.* San Marino, CA: Library of Congress Cataloging in Publication Data.

Larson, M.

2007 Personal communication between Mary Larson (CDFG) and Michelle Bates (Tetra Tech, Inc.) regarding a recent springs and seeps study conducted in Topanga Creek. May 2007.

Louie, L.

2005 Personal communication between Lisa Louise (USACE) and Michelle Bates (Tetra Tech, Inc.) regarding the Highway 101 Culvert. September 28, 205. `

Louisiana Pacific

1996 *Watershed Analysis Manual*. Red Bluff, California.

McEwan, D. and T. Jackson

1996 *Steelhead Restoration and Management Plan for California. Inland Fisheries Division, California Department of Fish and Game, The Resources Agency, Sacramento, CA.*

MEC Analytical Systems, Inc.

2001 *Preliminary Plan Formulation Report for the Rincon Creek Aquatic Ecosystem Restoration Project Santa Barbara/Ventura County.* Prepared for the U.S. Army Corps of Engineers, Los Angeles District.

Micheli, E.R., Kirchner, J.W., and E.W. Larsen

2004 Quantifying the effect of riparian forest versus agricultural vegetation on river meander migration rates, central Sacramento River, California, USA. River Research and Applications, 20: 537-548.

Moyle, P.B.

2002 *Inland Fishes of California. Revised and Expanded. University of California Press, Berkeley, CA.*

National Marine Fisheries Service

1997 *Aquatic properly functioning condition matrix, a.k.a. species habitat needs matrix.* National Marine Fisheries Service, Southwest Region, Northern California Area Office, Santa Rosa, CA. March 20, 1997. 22 pages.

Natural Resources Conservation Service (NRCS)

2007 Conservation and Areawide Planning Website, United States Department of Agriculture. http://www.nrcs.usda.gov/programs/planning/. Accessed May 2007.

Norris, R.

2003 *The Geology and Landscape of Santa Barbara County, California and Its Offshore Islands.* Santa Barbara Museum of Natural History Monographs Number 3. Santa Barbara, California.

Odgaard J.

1987 Streambank erosion along two rivers in Iowa. Water Resources Research 23(7): 1225–1236.

Peterson, N.P., Hendry, A., and T.P. Quinn

1992 *Assessment of cumulative effects on salmonid habitat: some suggested parameters and target conditions.* Prepared for the Washington Department of Natural Resources and the Cooperative Monitoring, Evaluation, and Research Committee Timber/Fish/Wildlife Agreement. University of Washington, Seattle, Washington.

Raleigh, R.F., Hickman, T.F., Soloman, R.C., and P.C. Nelson

1984 *Habitat Suitability Index Models: Rainbow Trout*. U.S. Department of Interior, Fish and Wildlife Service. FWS/OBS-82/10.24. Washington, D.C.

Reid, D.

2007 Personal communication between Dan Reid and Candice Constantine regarding the *Lower Rincon Creek Watershed Study* (Santa Barbara County 1999).

Reiser, D. W. and T.C. Bjornn

1979 *Habitat requirements of anadromous salmonids*. 54pp. in W.R. Meehan, ed. Influence of Forest and Range Management on Anadromous Fish Habitat in Western North America. Pacific N.W. Forest and Range Exp. Sta. USDA FOR. Serv., Portland. Gen. Tech. Rep. PNW-96.

Santa Barbara Coastal Long Term Ecological Research Project

2007 Information regarding sampling within Rincon Creek obtained from http://sbc.lternet.edu/.

Santa Barbara County

1929 Aerial Photograph. Provided by Mark Bright, Santa Barbara County Mapping Resource Center.

1938 Aerial Photograph. Provided by Mark Bright, Santa Barbara County Mapping Resource Center.

1950 Aerial Photograph. Job c-14500, date flown 6/09 1950, scale 1-600. Aerial photos by Fairchild Aerial Surveys, Los Angeles CA. Provided by Santa Barbara County Map Resource Center.

1956 Aerial Photograph. Book I of Santa Barbara, Goleta, Carpinteria. County of Santa Barbara Map Resource Center. Aerial photos by Mark Hurd Mapping Co., Goleta CA. 1956.

1999 *Lower Rincon Creek Watershed Study. A Field Investigation into the Source of Fecal Contamination in the Lower Rincon Creek Watershed and Ocean Interface (Surfzone).* Prepared by: Santa Barbara County Environmental Health Services Division. Prepared for: Santa Barbara County Public Health Department, Santa Barbara County Water Agency (Project Clean Water), and Heal the Ocean. October 1999.

2002 *Year 2001/2002 Water Quality Analysis Report.* Project Clean Water. September.

Santa Barbara County Agricultural Commissioner's Office

2007 Personal communication regarding crop damage in January 2007.

Santa Barbara County Association of Governments

2002 Regional Growth Forecast 2000-2030.
http://www.sbcag.org/PDFs/publications/Regional-Growth-Forecast.pdf

2006 Draft Regional Growth Forecast 2005-2040.

Santa Barbara NewsPress

1989 Article by Pamela Harper regarding Rincon Point. Article quotes Joan Hill Harbert, a landowner within the watershed.

Santa Barbara Salmon Enhancement Association (SB SEA)

1994 Letter addressed to Robert Treanor, Executive Director of the California Fish and Game Commission, from Joe Carrillo of SB SEA. Dated March 16, 1994. Document provided by the Center for the Ecosystem Management and Restoration (CEMAR) under the Southern Steelhead Resources Project.

Schueler, T. and H.K. Holland.

2000 The Practice of Watershed Protection. Center for Watershed Protection, Ellicott City, Maryland.

Shapovalov, L. and A.C. Taft

1954 *The life histories of the steelhead rainbow trout (Salmo gairdneri gairdneri) and silver salmon (Oncorhynchus kisutch) with special reference to Wadell Creek, California, and recommendations for their management*. California Fish and Game Bulletin No. 98.

Simon, A. and C.R. Hupp

1986 Channel Evolution in Modified Tennessee Channels. Proceedings of the Fourth Federal Interagency Sedimentation Conference, March 24-27, 1986, Las Vegas, Nevada, Volume II.

Spina, A.

2003 *Habitat Associations of Steelhead Trout near the Southern extent of their Range.* California Fish and Game 89(2):81-95.

Stoecker, M. and Conception Coast Project

2002 *Steelhead Assessment and Recovery Opportunities in Southern Santa Barbara County, California.* Prepared for California Department of Fish and Game and Wendy P. McCaw Foundation, June 2002. Conception Coast Project, Santa Barbara, CA.

Sylvester, A.G. and G.C. Brown

1988 Coastal Geological Society Guidebook 64, Ventura, California. Santa Barbara and Ventura Basins Tectonics, Structure, Sedimentation, Oilfields Along an East-West Transect.

Todd, A.H.

2000 Making decisions about riparian buffer width. Pages 445-450 in: P.J. Wigington and R.L. Beschta, editors. Riparian ecology and management in multiland use watersheds. American Water Resources Association, Middleburg, Virginia, TPS-00-2.

URS

1999 *South Coast Watershed Characterization Study. An Assessment of Water Quality Conditions in Four South Coast Creeks.* Prepared for the County of Santa Barbara, County of Ventura, City of Santa Barbara, and City of Carpinteria. August.

U.S. Forest Service (USFS)

2000 Los Padres NF Stream habitat and TES Occupancy Surveys for Rincon Creek. Data sheets and field notes from V. Hubbartt. Documents provided by USFS.

Ventura County

1945 Aerial Photograph. Job 9800. Index #: Mosaic. Scale: 1” –1,000ft. Aerial photos by Fairchild Aerial Surveys Inc., 1945.

1983 Aerial Photograph. Job PW 15546-37 (taken 7/09/1983). Aerial photos by Pacific Western Aerial Surveys, 1983-1984.

2001 Aerial Photograph. Provided by County of Ventura, GIS and Mapping Department.

2004 Aerial Photograph. Provided by County of Ventura, GIS and Mapping Department.

Ventura County Star

1992 Article by Dave Stone. December 28, 1992.

Webb, J.

2007 Personal communication with Jim Webb (Forest Service) and Candice Constantine (Santa Barbara County) regarding ongoing Forest Service practices within the Rincon Creek Watershed. March 2007.

Western Regional Climate Center
2007 California Climate Summarries. Accessed at http://www.wrcc.dri.edu/summary/climsmca.html.

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14.0 ACRONYMS

ATVs	All Terrain Vehicles
BAR	Barrier
BMI	Benthic Macroinvertebrates
BMPs	Best Management Practices
BPB	Backwater Pool – Boulder Formed
BPL	Backwater Pool – Log Formed
BPR	Backwater Pool – Root Wad Formed
BRC	Beach Report Card
BRS	Bedrock Sheet
Caltrans	California Department of Transportation
CAP	Continuing Authorities Program
CAS	Cascade
CCAMP	Central Coast Ambient Monitoring Program
CCP	Channel Confluence Pool
CDFG	California Department of Fish and Game
CEC	Community Environmental Council
CEMAR	Center for Ecosystem Management and Restoration
CNDDB	California Department of Fish and Game Natural Diversity Database
CRP	Corner Pool
CSBP	California Bioassessment Procedure
CSC	California Species of Special Concern
DO	Dissolved Oxygen
DPL	Dammed Pool
EDW	Edgewater
FE	Federally Endangered
FLAT	Flatwater
GIS	Geographic Information System
GLD	Glide
GPS	Global Positioning System
HGR	High Gradient Riffle
HU	Habitat Unit
LCA	Land Conservation Act
LGR	Low Gradient Riffle
LSBk	L. Scour Pool – Bedrock Formed
LSBo	L. Scour Pool – Boulder Formed
LSL	L. Scour Pool – Log Enhanced
LSR	L. Scour Pool – Root Wad Enhanced
LTER	Long Term Ecological Research Project

MCP	Mid-Channel Pool
NA	Not Applicable
NOAA	National Oceanic Atmospheric Administration
NRCS	Natural Resources Conservation Service
NSF	National Science Foundation
NTUs	Nephelometric Turbidity Units
PCW	Project Clean Water
PLP	Plunge Pool
POOL	Pool
POW	Pocket Water
PVC	Polyvinyl Chloride
PWA	Philip Willams & Associates
RCD	Resource Conservation District
RCWC	Rincon Creek Watershed Council
RIF	Riffle
RUN	Run
RWQCB	Regional Water Quality Control Board
SBCLTER	Santa Barbara Coastal Long Term Ecological Research
SCP	Secondary Channel Pool
SRN	Step Run
SSRP	Southern Steelhead Resources Project
STP	Step Pool
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
TRP	Trench Pool
UCSB	University of California, Santa Barbara
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WMA	Weed Management Area

Philip Williams & Associates
Sediment Yield Appendix

Philip William & Associates compiled previous studies reporting on sediment yield estimates along the Transverse Mountain Ranges in particular, and from California, in general. Below is a list of previous studies and their findings on sediment yield in the Santa Barbara/Ventura region.

1. Keller et al., (1997) reported annual average sediment production for pre-burn Santa Barbara area watersheds as estimated by Rowe et al., (1949) using the United States Forest Service method based on parameters such as locality, soil type, underlying geology, and slope (see Table 1).

Table 1: Reported Annual Average Sediment Production for Santa Barbara Drainage Areas

Drainage	Sediment Production Annual Average (kg/ha)
Maria Ygnacio West	2.90×10^4
Maria Ygnacio East	1.46×10^5
San Antonio	2.01×10^4
San Jose	2.38×10^4
Atascadero	1.58×10^4
Average	**2.43×10^4**

2. Simon, Li and Associates (1984) reported average annual sediment yields for Mission and Rattlesnake Canyons in Santa Barbara, California which when combined gave a value of 8.7 x 103 kg/ha (Table 2).

Table 2: Sediment Yields from Local Watersheds

Watershed Name	Drainage Area (hectares)	Annual Sediment Yield (kg)	Annual Sediment Yield (kg/ha)
Mission Canyon♣ Rattlesnake Canyon♣	2,980*	2.6×10^7	8.7×10^3
Santa Ynez Mountain♦	90,100	1.8×10^9	2.0×10^4

*watershed areas combined in analysis

♣Army Corps of Engineers by Simons, Li and Associates, 1984.

♦Brent D. Taylor, A.M. ASCE, 1981.

3. Taylor (1981) reported an actual average annual upland erosion rate for the Santa Ynez Mountains in Santa Barbara, California of 2.0 x 104 kg/ha. Taylor (1981) also reported estimated sediment yields for Cachuma, Gibralter and Matillija reservoirs and Piru Lake (Table 3).

Table 3: Sediment Yields for Santa Ynez Mountain Areas

Reservoir Lake	Sediment Yield (kg/ha)
Gibralter	1.7×10^4
Cachuma	1.1×10^4
Matillija	4.8×10^4
Piru	3.9×10^4

4. Armanino et al. (2000) study estimated the average sediment yield, based on kg of sediment produced divided by watershed area, for an average rain year (1995/96) to be 2.6×10^4 kg/ha and 7.2×10^4 kg/ha during a year with 76% higher than average rainfall (1994/95).

5. Average annual sediment loss for California ranges from a low of 4.6 x 103 kg ha/ to a high of 1.95 x 104 kg/ha (Dunne And Leopold, 1978).

6. Inman and Jenkins (1999) reported annual net sediment yield for the Santa Ynez River of 1.50 x 104 kg/ha for the period 1969 to 1995 based on suspended sediment data from USGS gauging stations. These values do not include sediment trapped behind dams.

REFERENCES

Armanino, D.L., Clemens, J.A.G., Coburn, C.H., Molotch, N.P., Oakes, S.A., and J.K.Richardson. 2002. Analysis of Alternative Watershed Management Strategies for the Lauro Canyon Watershed, Santa Barbara County, California.

Dunne, T. and Leopold, L.B.. 1978. Water in Environmental Planning.

Inman, D.L. and S.A. Jenkins. 1999. Climate Change and the Episodicity of Sediment Flux of Small California Rivers. The Journal of Geology, 107: 251-270.

Keller, K.A., Valentine, D.W., Gibbs, D.R. (1997). Hydrologic Response of Small Watersheds Following the Southern California.

Simons Li & Associates Inc. (1984). Debris Deposition Study For Without-Project and With-Project Conditions, Santa Barbara County Streams, Mission Creek/Rattlesnake Creek. Santa Barbara, CA, Department of the Army, Los Angeles District, Corps of Engineers: 85.

Taylor, B. D. (1981). Sediment Management for Southern California Mountains, Coastal Plains and Shoreline; Part B: Inland Sediment Movements by Natural Processes. EQL Report No. 17-B.